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The contract price for street cleaning at Philadelphia for the year 1895, and of collecting and disposing of the garbage "in a manner not prejudicial to public health," aggregates $755,791, of which $503,651 is for street cleaning and $252,140 for garbage collection and disposal. The prices for this work in each district, with the contractors, were given in our Construction News columns in our issue of Dec. 6. It is understood that the garbage will be burned or otherwise treated in a sanitary manner.

A great amount of sewer work is planned at Peoria, Ill., for next season. Some 40 miles of brick and tile sewers are to be laid, the largest 7 ft. 4 ins. in diameter. The total cost will probably exceed $400,000. This, in connection with the work which has been done in the city during the past three or four years, is an excellent example of the rapid strides which cities in the West and South are making in the improvement of their sanitary surroundings. The work will be under the direction of Mr. Jacob A. Harman, City Engineer of Peoria.

The board of engineers appointed by the President some time ago to report on the most feasible route for a ship canal between Chesapeake and Delaware bays has reported in favor of the Back Creek route, which practically follows the line of the existing canal, on the ground that it is best adapted to national defense and will give the best facilities to commerce. The length of the canal would be 13.6 miles and its cost, with a depth of 27 ft. of water throughout, with 178 ft. width at low-water mark and 100 ft. at bottom, is estimated at $7,600,000. While the Back Creek route recommended is a much more feasible enterprise commercially, by reason of its small cost, than any of the other routes examined, it is also much superior as respects national defense, for the fortifications already projected for the defense of Philadelphia by a board of army engineers will also serve to protect the eastern entrance of the canal. The members of the board were Gen. Thos. Lincoln Casey, Chief of Engineers; Col. Wm. P. Craighill, President, and Mendes Cohen, Past President, of the American Society of Civil Engineers; Capt. Geo. Dewey, U. S. N., and Mr. E. Porter Alexander, C. E., of Savannah, Ga.

The New York & New Jersey Bridge Co., by its managing officers interviewed by a New York "Sun" reporter, declares that as far as that company is concerned the bridge across the Hudson River must be a cantilever, or none at all, despite the practical recommendation of the suspension type in the reports of the U. S. Engineers on the subject. They estimate $20,000,000 as the cost of terminals and land in New York, and figure upon $3,500,000 as the maximum annual income from the bridge. Of this sum taxes and cost of maintenance would amount to $1,250,000, leaving $2,250,000 for interest-paying purposes. At 5% this sum would pay interest on $45,000,000; and deducting $5,000,000 for interest and expenses during erection, the sum left for bridge building purposes is $20,000,000. The Union Bridge Co. has prepared plans and is ready to erect a suitable six-track cantilever bridge of 2,000-ft. span for this sum. As to the river-pier foundation, that company claims, and it has a warrant in experience for its claim, that it is not essential to found the pier on rock 200 ft. below the river surface. It doubts the feasibility of dredging out the pockets or cylinders of a pier sunk to that depth, with 200 ft. of bottom material. They would propose to sink four 60-ft. cylinders to and into a bed of hard sand 200 ft. below the river surface and stop there; and their estimate for such a pier is $3,500,000, instead of $9,700,000, as estimated by the Board of Civilian Engineers. As the Union Bridge Co. says, it is purely a matter of first cost compared with prospective income, rather than one of suspension or cantilever bridge, and that company believes that the cantilever is the cheapest for the purpose.

The most serious accident of the week was a head collision on the Carolina Central R. R., near Charlotte, N. C., Dec. 6, caused by the usual disregard or misunderstanding of passing orders. One man was killed and another seriously injured.

The boiler of a traction engine supplying steam for drilling a well near Carey, O., exploded Dec. 7, killing one man.—A boiler of a sawmill at Washington, N. C., exploded Dec. 10, owing, it is said, to low water; five persons were killed.

The dangers of grade crossings of steam and cable roads were again instanced by a collision at the Broadway and Seventh St. crossing, Oakland, Cal., Dec. 4, a cable car being smashed by a local train, killing one person and injuring another. The cable road company's rules require the gripmen to stop at the crossing until the conductor goes ahead, neither of which rules were obeyed, and the railway flagman is also said to have neglected his duty.

An electric car was overturned in Bronxdale N. Y., Dec. 6, while traveling rapidly round a sharp curve. The passengers were cut and bruised, and had to be taken out through the windows.

A serious rear collision between the West Side cable railway trains occurred in the Washington St. tunnel, Chicago, Ill., about 6 p. m., Dec. 11, in which two persons were killed, ten seriously injured and a number more or less cut and bruised. A Milwaukee Ave. train of grip car and two trail cars, carrying nearly 250 persons, ran away while descending the steep grade into the tunnel, owing to the failure or breaking of the grip and the failure of the brakes, and ran into a Madison Ave. train ahead with the same number of cars. The light trail cars of the head train were wrecked, and the passengers imprisoned in the wreck, while fire from a broken stove added to the danger.

A dynamite explosion occurred in Franklin Park, Boston, Mass., last week on the excavation of a driveway from the Retreat to Seaver St. Men were engaged in clearing away the debris resulting from the blast of 20 to 30 holes charged with dynamite, and work was going on carefully, as it was thought that two or three of the holes had not been discharged. A charge or an unexploded cap was struck by a pick by one of the men, and the explosion killed two men and injured two others.

The Queen Lane reservoir controversy in Philadelphia has been brought to an end by the report of a board of expert engineers, practically vindicating the contractors. Charges were made early in this year that the specifications were not being carried out, that bad puddling clay was being used, and that this was insufficient in quantity, that the cement lining was bad, etc. Mayor Stuart finally appointed Messrs. John A. Wilson, J. G. de Kinder and A. Feldpauche, all experienced civil engineers, a board of experts to examine into and report upon these charges. Two reports were submitted. The majority report of Messrs. Wilson and Feldpauche states that on close examination by special surveys by cutting into the sides and bottom, and otherwise examining the material, they find no ground for the charges. But they do find some variations from the original plans, some due to defects in these plans, some unauthorized but beneficial to the city, and others authorized by the Director of Public Works. Mr. de Kinder reports that clay was used obtained from pits on the ground, though this use was authorized by the engineer of the Water Department; over one-half of the bottom area slag had been used in the concrete instead of broken stone as specified; a concrete lining, 12 ins. thick at bottom and 6 ins. thick at top, had been substituted on the lining of the reservoir sides for "two courses of brick laid in mortar," as specified. But he finds these changes authorized by the city, and says they were in the interest of the city. The clay used was good, and the concrete lining of the slopes was "exceptionally good," says Mr. de Kinder. In the bottom concrete he found only one soft spot, due to improper mixture of materials. The computations of the experts show absolutely no shortage of clay, as charged. The bottom of the reservoir was raised 1.35 ft., as charged but it was done by authority, and saved for the city the cost of 83,070 cu. yds. of excavation. Mr. de Kinder states, however, that while the specifications permitted the use of material found on the ground for the embankments, he considers this material as inferior to such as would be required by the best practice; like much of the soil about Philadelphia, it is more or less micaceous. The parties making the charges declined to appear before the board of experts, and were absent from the city during the investigation. While the typical cross-section on the plans called for outer slopes of 2 to 1, the experts find that owing to the location of the reservoir by the city engineers and the proximity of surrounding streets, these slopes were reduced to from 1.80 to 1 to a minimum of 1.21 to 1. But to compensate for this, the inner slopes were flattened and the top width increased in places. A summary of extra work done and of work omitted by authority shows a balance of $9,684 in favor of the city. The contractors were Messrs. Porter, Filbert & Co.

The international ship canal project, to connect the Great Lakes with the Atlantic, inaugurated at the Toronto Deep Waterways Convention, has taken the form of the draft of a bill which will be presented to the next Congress. The bill was drawn by the executive committee of the convention, and provides for the appropriation of $50,000 by the United States and the appointment of an international commission to consider the engineering and financial requirements of the scheme. This commission is to be made up of five civilian engineers, one engineer from the war department and one from the navy. Canada is to provide a like number of representatives.

The annual report of the Brooklyn bridge trustees for the year ending Dec. 1, 1894, is of especial interest just now in connection with the proposed bridges across the Hudson River. This report may be tabulated as follows:

Total receipts from tolls		$1,199,084.14
From railway	$1,101,815.88	
From carriageway	87,268.36	
Dec. in tolls from last year	53,823.90	
Passengers carried on railway		41,714,235
Aver. monthly tolls for 1893		$104,409.00
Aver. monthly tolls for 1894		99,923.67
Tot. receipts from all sources		1,850,142.18
Total expenditures		1,521,660.94
Balance on hand Dec. 1, 1894		328,481.24

The telegraph and telephone companies paid $22,071 for the privilege of stringing wires on the bridge. The single fare on the railway is now 3 cts., or 10 tickets for 25 cts., and since July 1, 1894, 2 tickets for 5 cts. Under the terms of the Act of 1891 authorizing the trustees to improve the Brooklyn terminal, at the cost of the city of Brooklyn, they have expended for real estate, legal expenses, paving, sewerage, etc., the sum of $1,749,271.21 out of $1,757,000, drawn from the city treasury, with the addition of $4,218.85 received for interest, or a total of $1,761,218.65. Since the bridge was opened, 11¼ years ago, 346,589,521 passengers have been carried. The greatest annual traffic was 43,298,486, in the year ending July 31, 1893. On the bridge railway during the past year only 2h. 47m. were lost in all from delays from all causes. Of this delay only 30¼% was due to failure or defects in the cable-hauling machinery; the remainder were due to ordinary accidents common in railway transportation. Work has been commenced upon a plant to light the cars by electricity. In the total period of service of the bridge, 11¼ years, eight hauling cables have been in use, and of these six have been worn out and removed.

The danger of cultivating oysters near the outlet of sewers has been illustrated within the past month in Connecticut. An epidemic of typhoid broke out among the students of Wesleyan University, at Middleton, Conn., and its cause has been carefully traced by Dr. C. A. Lindsley, Secretary of the State Board of Health, working in conjunction with others, to oysters eaten by the students. These oysters were placed for a short time in a fresh water creek at New Haven, for freshening and fattening, within 300 ft. of the outlet of a private sewer from a house where there were two cases of typhoid.

THE NEW WATER SUPPLY FOR SYRACUSE, N. Y.

By Thos. McE. Vickers.

(With Inset.)

The first work done in the construction of the new municipal works for supplying the city of Syracuse with water from Skaneateles Lake was the rebuilding of the state dam at the foot of the lake and the laying of a 54-in. steel intake pipe from a timber crib to a gate house on the shore of the lake, a distance of about 6,500 ft.* The contractor for furnishing the pipe for the intake

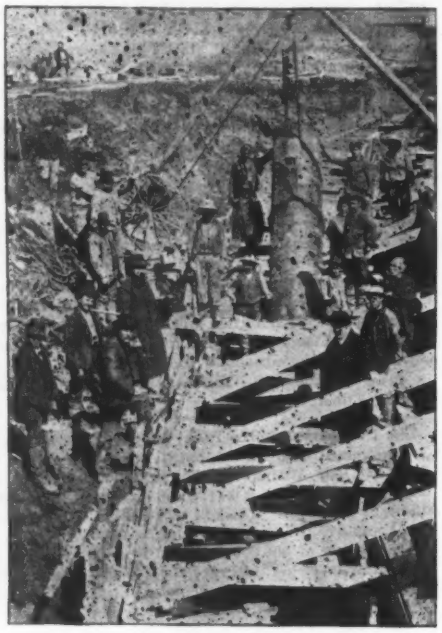


Fig. 3. View Showing Bracing in Deep Cut on Section I.

was the Groton (N. Y.) Bridge & Mfg. Co., the work having been let to it April 4, 1892, for $59,802. The pipe was made in 6-ft. lengths each of which was slightly conical in form so that the small end of one fitted into the larger end of the next. Five of these were riveted together, forming a section 29 ft. 2 ins. in length. These sections were shipped thus from the shops to Skaneateles Lake, where four sections were riveted together, forming one section 116 ft. in length. These sections were floated out into position, sunk and joined by a specially-devised joint, shown by Fig. 8 in the text. Seven flexible joints were used on the intake, and their design is shown by

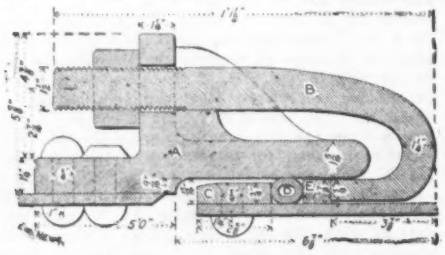


Fig. 8 Hook Bolt Joint on 54-in Submerged Steel Intake; Syracuse, N. Y.

(A, cast iron bell; B, steel hook bolt; C, steel spigot; D, soft lead pipe; E, wrought iron loop.)

Fig. 9. (These two cuts are reproduced, for convenience, from our issue of June 15, 1893.—Ed.)

The work of laying the pipe progressed in both directions, from the crib and from the gate house, the final connection being made by means of a specially-constructed sleeve joint, shown by Fig. 10.

* This work was fully described in Eng. News for June 15, 1893, in a paper by Mr. Wm. R. Hill, M. Am. Soc. C. E., Chief Engineer of the Syracuse Water Board. In our issue for Feb. 23, 1889, a report was abstracted in which Mr. J. J. R. Croes, M. Am. Soc. C. E., reported on possible sources of supply for Syracuse and a test of the wells from which the supply then being furnished by a private company was being drawn in 1891. The city bought the private works, as outlined at length in Eng. News of Sept. 14, 1893, and since purchasing them has made important improvements, as described in this article.

The intake pipe was laid by Hingston & Chapman, of Buffalo. This contract also included the following work: Rebuilding the state dam at Skaneateles and raising its crest 2 ft.; constructing the intake gate house, dredging the lake channel to a depth of 15 ft. below the crest of the old dam, or 17 ft. below that of the present one; rebuilding the abutments of the bridge crossing the outlet just above the dam. All this work was let for $86,575 to the above-named contractors on April 4, 1892. It was completed, with the exception of dredging the creek channel below the dam, about the middle of January, 1894. With the close of the canal season, Dec. 1, the water was shut off from Skaneateles outlet, and the work of dredging it commenced. From the dam one mile down this is being done. Shovels and wheelbarrows are used, except near the upper end, where wagons will be employed, the material to be used as filling back of a new sea-wall, on the lake front. The remainder of the material (hauled in barrows) is "spoiled" along the banks of the creek, improving some low lands.

After extensive and careful surveys the conduit line conveying water from Skaneateles Lake to Woodland Reservoir, the new distributing reservoir now under construction, was located as shown by the accompanying map, Fig. 1 on the inset sheet. One of the most important points borne in mind in the location of the line was to have as few summits and depressions as possible. The number of these was reduced to a minimum without appreciable increase in length of the line. In no place does a summit rise above the hydraulic grade line. There are five intermediate summits and six low points, the last end of the line being on an ascending grade; at the lowest point of each depression is placed a blow-off and air-valves are placed at all summits. The distribution of these air valves, blow-offs and the stop gates are shown on the accompanying profile, Fig. 2 on the inset sheet. For nearly the first two miles (102 stations) the line, in order that it should be kept below the hydraulic grade, is in very deep cutting, reaching a depth of 30 ft. The remainder of the line is made to follow very nearly the surface of the ground, with a minimum covering of 4 ft.

The specifications for the pipe used in the construction of the conduit line called for varying thicknesses according to the location and corresponding pressure that each part would have to stand. Thus the pipe was divided into nine classes, varying in thickness by 1-16 in., as shown in the accompanying table, which also gives the names of the contractors for the various thicknesses of pipe, the price per ton and the total amount of each contract, the total cost of the pipe alone having been $365,582.

On Oct. 3, 1892, bids were received for the construction of the conduit line. This work was divided into four sections, arranged as shown on profile. These were let as follows:

Section I., John Cornwell, Jr., New York city, $89,673.
" II., Jos. A. Flynn, New York city.... $84,946
" III., Clinton Beckwith, Herkimer, N. Y., $80,184.
" IV., Francis Curnan, Rhinebeck, N. Y., $57,442

The work on Sections II., III. and IV. was all satisfactorily completed by the contractors. On Sec. I., however, after completing the least difficult portions of the work, the contractor abandoned his contract, leaving about 17,000 ft. of pipelaying, together with the work incidental thereto, untouched. This work was completed by the Syracuse Water Board. This portion of the work abounded in very difficult construction and was by far the most difficult portion of the whole conduit line. The greater part is located along the Skaneateles Creek and includes a crossing of that stream. The excavation was principally in quicksand, and deep cutting, averaging 25 ft. in depth and reaching a maximum of 30 ft. The progress of the work was necessarily very slow, at some times not averaging over a 12-ft. length a day. It was, of course, necessary to sheet all of this trenching, and even with this done the sides of the trench would crack 10 or 15 ft. back of the sheeting and the whole mass, sheeting and all, for several hundred feet in length would gradually sink 10 or 12 ft., and as fast as the trench was excavated the material would come up through the bottom until a flooring was made to prevent it, thus completely boxing in the trench. To obviate this sinking, holes were cut in the sheeting opposite the cavities formed by the material running down, and these cavities were filled with hemlock brush and rubbish.

The method of sheeting was made to conform to the necessities of any particular circumstances, the principal types being shown in Fig. 11 in the text.

The full section at the left and the plan show the general method used, with counterbraces added to prevent unequal settlement on either side, caused by the cracking of the banks and the soft material coming up through the bottom, as above stated. If one side of the trench was firm, the counterbracing would frequently hold the opposite side in place and prevent further settlement or cracking.

In fine running sand and water it was possible to keep the trench excavated several feet ahead of the flooring, which was then laid lengthwise on cross sills, the ends being secured by caps and posts, as indicated. Frequently it was impossible to keep the excavation ahead of the flooring at all. Then the second method of flooring shown was used, 6 × 6-in. rangers being worked down to grade along the side of the sheeting and spiked. Enough material was shoveled out to lay one cross plank 4½ ft. long at a time, and secured by caps and posts, as indicated. The pipe was then laid directly on this flooring. The timber used was of spruce and the sheeting of 2-in. spruce planking.

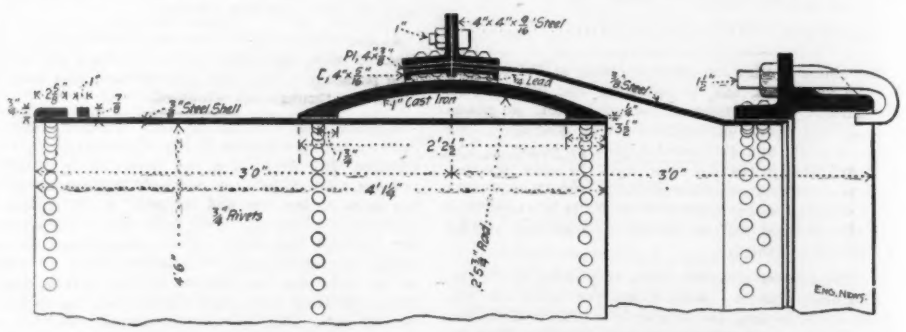


FIG. 9. UNIVERSAL FLEXIBLE JOINT ON 54-IN. STEEL INTAKE.

A general view of the framing in a deep cut on Sec. I., with a pipe being lowered into place, is shown by Fig. 3 in the text.

In the course of the conduit it was necessary to cross two deep ravines, which formed notable points in the construction of the line. These are located on Sec. III. The first of these, known as Marcellus Ravine, is a narrow valley, about 500 ft. in width and about 80 ft. in depth. The bottom is quite level and the sides slope up abruptly at an angle of about 40°. The outlet of Otisco Lake, known as Nine Mile Creek, flows through this valley, and is a very considerable stream of water. The line was located at this point so as to cross the stream where it was divided into two channels, each about 20 or 30 ft. wide. The larger of the two channels lies right under the eastern slope of the ravine, while the smaller branch lies about 100 ft. to the west. The water was first diverted entirely into the eastern channel and the pipe laid under the other and up to the western bank of the eastern stream. The water pressure test having then been applied and everything proving satisfactory, the trench was refilled, the old bed of the western channel paved

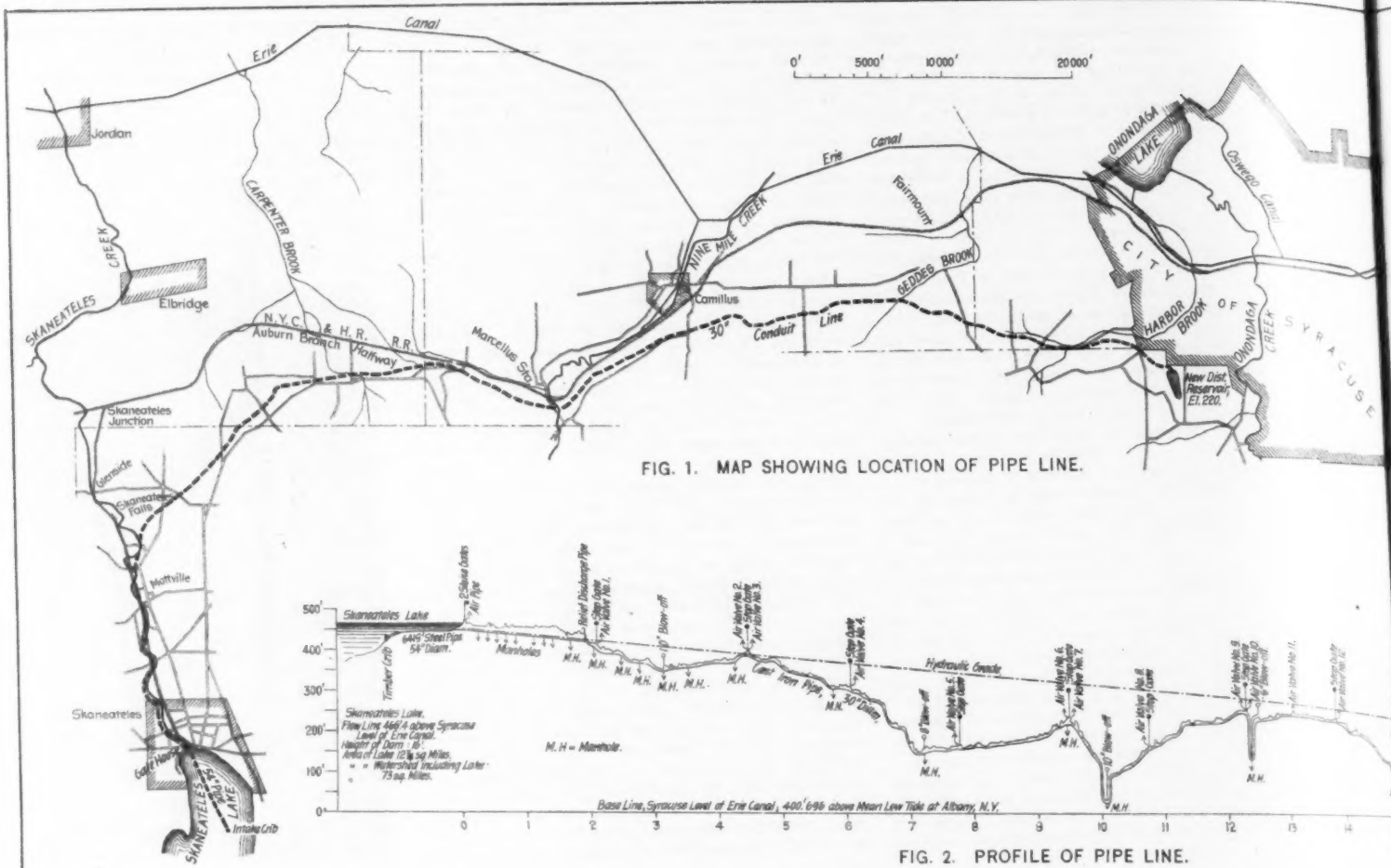


FIG. 1. MAP SHOWING LOCATION OF PIPE LINE.

FIG. 2. PROFILE OF PIPE LINE.

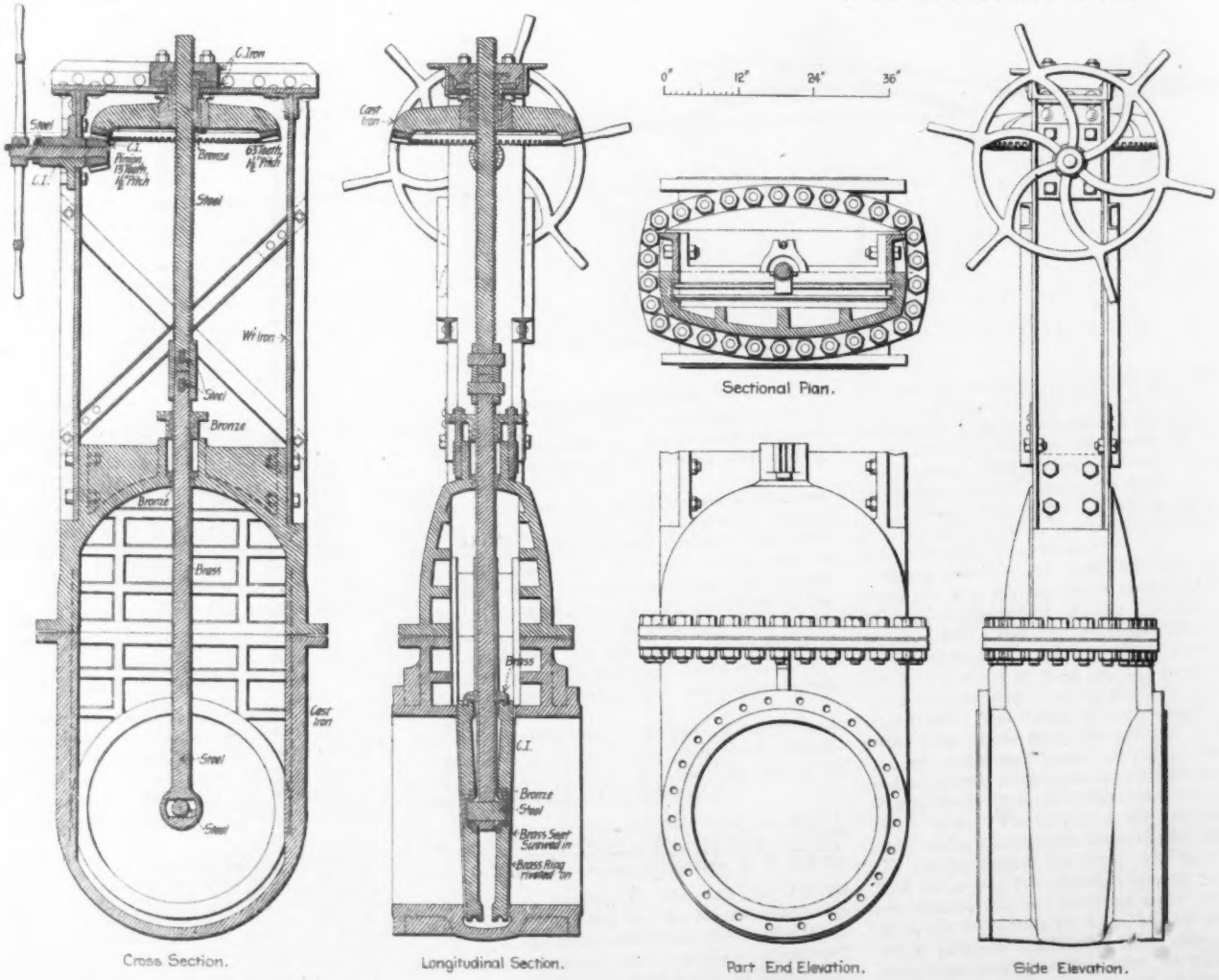


FIG. 5. DETAILS OF 30-IN. STOP GATE.

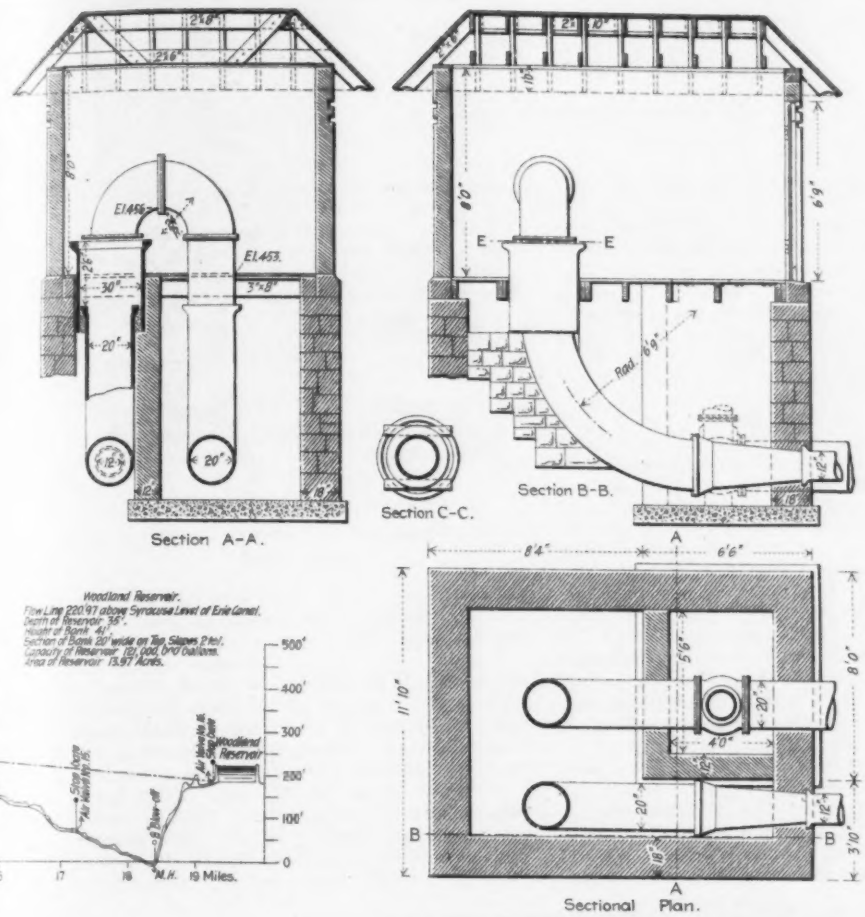


FIG. 6. DETAILS OF RELEIF PIPE ON CONDUIT.

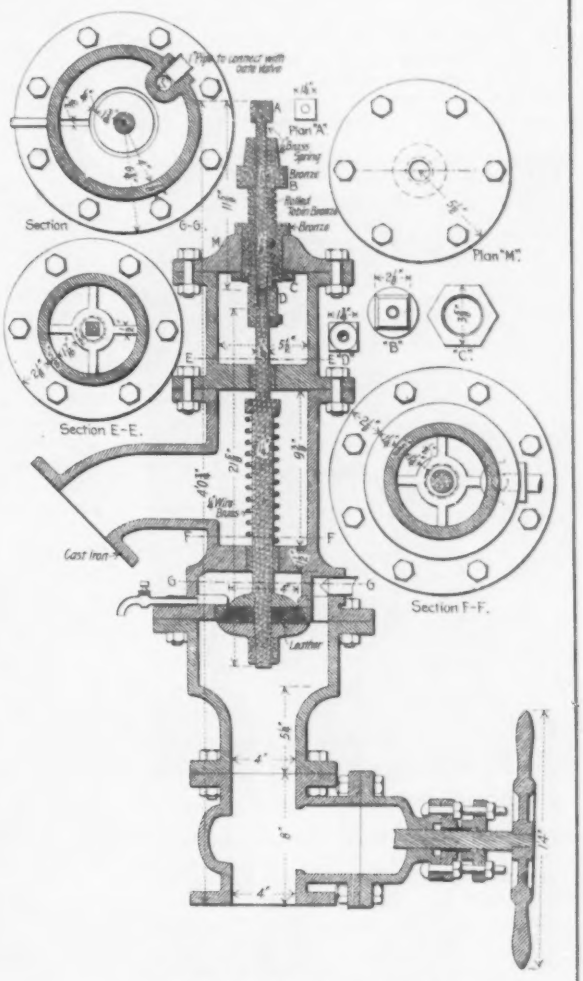


FIG. 8. DETAILS OF 4-IN. AIR VALVE.

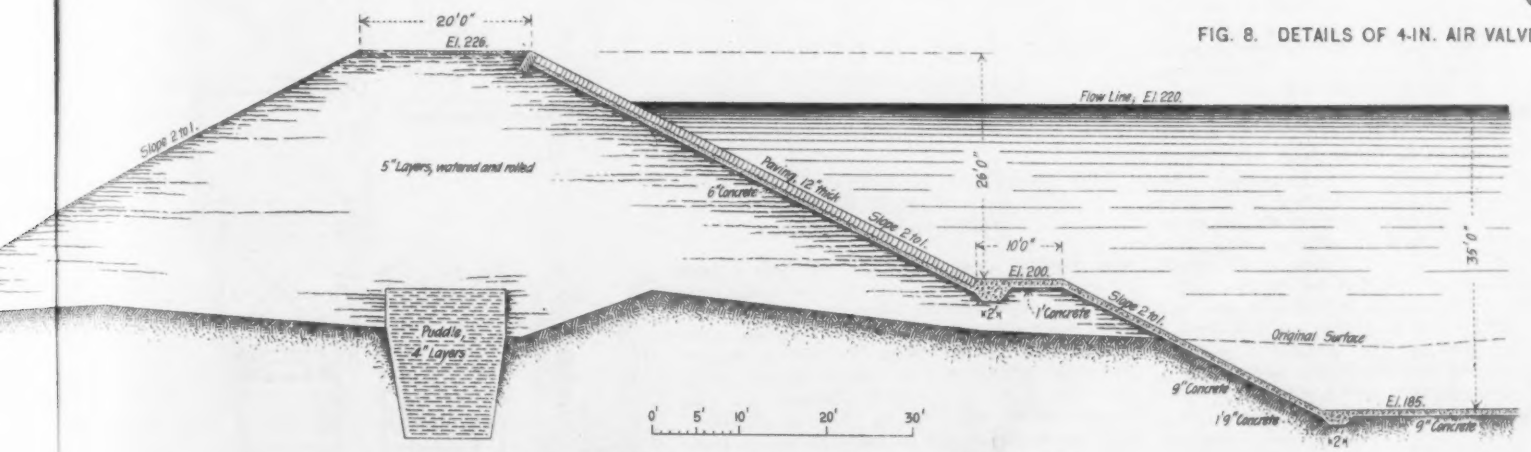


FIG. 7. SECTIONS OF WOODLAND RESERVOIR EMBANKMENT.

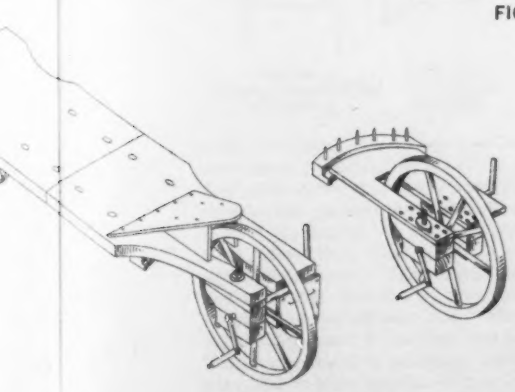


FIG. 4. INSPECTING WAGON
FOR EXAMINING INTERIOR OF PIPE ON SEC. I.

THE NEW WATER SUPPLY OF SYRACUSE, N. Y.

Wm. R. Hill, M. Am. Soc. C. E., Chief Engineer.

Howard Soule, M. Am. Soc. C. E., Consulting Engineer.

CHAS. HART & SONS, LITH., 30 VESEY ST., N. Y.

Thicknesses of Pipe Under Various Heads, Names of Contractors, and Prices, Syracuse Main Conduit.

Class.	Thickness, ins.	Maximum head, ft.	Contractor.	Price, per short ton.	Amount of contract.
A	¾	165	Dennis Long & Co., Louisville, Ky.....	$21.75	$111,950*
B	15-16	205			
C	1	255	Radford Pipe & Foundry Co., Cincinnati, O.	20.12	176,876
D	1 1-16	295			
E	1⅛	335			
F	1 3-16	375	McNeal Pipe & Foundry Co., Burlington, N.J.	20.50	79,756*
G	1¼	415			
H	1 5-16	460			
I	1⅜	475			

* A small portion of Class C was included in the contract of the McNeal Co. at $20.50 a ton.

and the whole volume of the stream turned into it. The work of pipelaying was then continued under the eastern channel and up the slope and connected at the top with the line which had already been

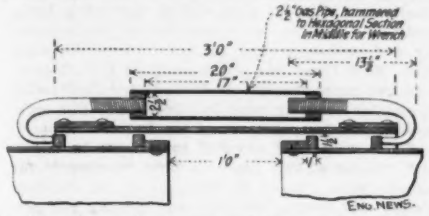


Fig. 10. Sleeve Joint for Last Connection in 54-in. Steel Intake.

laid from that point east. After a careful test of this portion, the eastern channel was paved and the whole stream finally diverted into it, abandoning the western channel.

Camillus Ravine is only some 20 ft. wide on the bottom and about 100 ft. in depth. Its western slope, shown by Fig. 12, in the text, is quite 45°: the eastern slope is not so steep and is interrupted by a bench about 25 ft. above the lowest point and about 60 ft. wide. Higher up in the ravine a stream is found, but descending it disappears some distance above the point where the conduit line crosses. It was to be expected that trouble would be met with from this cause. The surface in the ravine consisted of a rather hard shale rock. This was found to extend down about 6 ft., at which depth the excavation broke through, discovering a considerable pocket of quicksand and water. To form a foundation on which to lay the pipe, piles were driven to a depth of 12 ft., where rock was again encountered. These piles were timber capped and concreted, and on the foundation thus formed the pipe and specials were laid. The method of testing the pipe when it was laid was briefly as follows: The pipelaying was generally carried up to a stop gate and enough lengths of pipe were laid beyond to act as a brace to keep the joints from giving. Where a gate could not be used, a special length was jointed to the pipe and an iron bulkhead bolted on. This was braced against the end of the trench with timber and jacks, to take up any give in the backing. A connection was then made with a pumping engine and the pipe filled with water and the pressure raised to the required amount.

The details of the 30-in. stop gates are shown in Fig. 5, on the inset, and of the 4-in. air valves by Fig. 8, on the inset, the locations of these devices being given on the profile, Fig. 2, on the inset.

The stop gates each have two 8-in. by-passes. They are set vertically, with one by-pass on each side. They are outside stem gates and were designed especially for the Syracuse Water-Works, as were also the air valves. These accessories were furnished by the Eddy Valve Co., of Waterford, N. Y., the air valves at $40.25 and the stop gates at $500 each.

It was deemed advisable on Sec. I., where the pipe was in such deep cutting, to examine the interior of the pipe, and before the water was let in. As crawling through a 30-in. pipe is very slow and painful work, Mr. Robert Marcher, Engineer-in-Charge of Sec. I., devised a machine for travelling through the pipe, shown by Fig. 4, on the inset. It consisted of a body, made in two parts, to allow it to be introduced into the pipe through a manhole. This was furnished with two 8-in. wheels behind and a 16-in. wheel in front, with steering gear and a crank attached to the axle, for propelling the wagon. Provision was made for a lamp in front. On this wagon the inspector laid himself flat, and steering with one hand and propelling with the other, a thorough examination could be made in a short time.

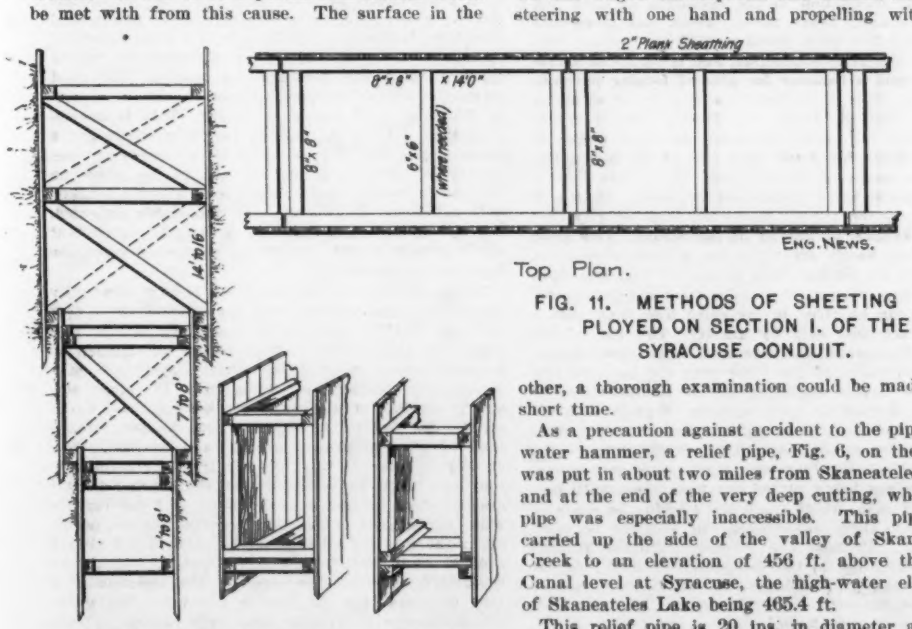


FIG. 11. METHODS OF SHEETING EMPLOYED ON SECTION I. OF THE SYRACUSE CONDUIT.

As a precaution against accident to the pipe from water hammer, a relief pipe, Fig. 6, on the inset, was put in about two miles from Skaneateles Lake and at the end of the very deep cutting, where the pipe was especially inaccessible. This pipe was carried up the side of the valley of Skaneateles Creek to an elevation of 456 ft. above the Erie Canal level at Syracuse, the high-water elevation of Skaneateles Lake being 465.4 ft.

This relief pipe is 20 ins. in diameter and the overflow is arranged as the plan shows, an open space being left at C C, in order that the pipe shall not act as a siphon. Just below this point in the discharge pipe is placed a wire screen to prevent the possibility of frogs, etc., passing up and into the relief pipe and thence to the main conduit line. There is a valve in the relief pipe just below the overflow, as shown. The upper end of the relief pipe is enclosed in a plain brick structure. After the water was first turned into the conduit it was not shut off again, as no breaks occurred, and the water reached the city without any serious delay within a few minutes of the time when it was calculated that it would do so. This seems almost unprecedented, as in other similar works serious leaks or breaks have appeared on the first turning on of the water. It was due both to the exceeding care with which all work was inspected and also to the precautions taken during the first progress of the water toward the city.

The gates at Skaneateles were opened June 29, 1894, at 10.50 a. m., thus letting the water into the conduit line. The water appeared at the north stop cock vault of the Woodland Reservoir at 4.10 p. m. July 3, no mishap having occurred during the filling of the line. The flow of water to the city has been uninterrupted from that time to this.

Woodland Reservoir, Fig. 7, on the inset, is designed to be the main distributing reservoir for the new water-works system. It is situated just outside the city limits southwest of the city, at an elevation of 220.97 ft. above the Erie Canal at Syracuse. A large portion of the city has an elevation of less than 10 ft. above the canal level, so that there is practically a head of 220 ft. for a considerable part of the city. The reservoir is 35 ft. in depth, with its banks 6 ft. above the high-water mark, making a total depth from top of bank to bottom of reservoir of 41 ft. The area of its water surface is 13.97 acres and it has a capacity of 121,000,000 gallons, which is equivalent to a 15-days' supply. The Wilkinson Reservoir, formerly the main distributing reservoir, has an elevation of about 110 ft. above the canal, and is used now only to receive the overflow from the Woodland Reservoir. The capacity of Wilkinson Reservoir is about 80,000,000 gallons.

Fig. 12. Western Slope of Camillus Ravine.

The contract for building the Woodland Reservoir was let to A. Van Wagner & Co., of Syracuse, for $255,355, the bids being received Nov. 30, 1892.

During November, 1894, the work on the Woodland Reservoir was discontinued for the winter, the reservoir being in a state very near completion, the paving on the upper part of the slopes being yet unfinished.

To protect the concrete lining of the reservoir from the action of frost, the flow of water in the conduit was increased Nov. 10, so that about 2,000,000 gallons more than the city is using per day was let down. This surplus has been flowing into Woodland Reservoir. Dec. 3 the water had reached a depth of 20 ft., and it was desired to keep it at about this depth. To secure this end without shutting off the reservoir from the city system, also without allowing the water from the reservoir (which is roily, etc.) to pass into the mains a gate was opened letting the same amount waste into the Wilkinson Reservoir as was flowing into the Woodland. Thus the pressure in the city is obtained from Woodland Reservoir.

When the Syracuse Water-Works came into the possession of the city there were 40 miles of pipe of all sizes, some of cast iron and some of cement. Before increasing the pressure in the city all the cement pipe was replaced with cast iron and some of the iron pipe of small sizes was also replaced with sizes better adapted to the growth of the city. Thus 14 miles of pipe of 12 ins. in diameter and

under have been removed. Up to the present time the city has laid 57 miles of pipe, so that the total mileage is at present 83 miles. Forty-seven miles of pipe have been laid during 1894. Mr. Wm. R. Hill, M. Am. Soc. C. E., has been the chief engineer for this work, and since Sept. 1, 1894, he has been, in addition, superintendent of the waterworks. Mr. Howard Soule, M. Am. Soc. C. E., has been employed as consulting engineer.

NOTES ON STEEL FORGINGS.*

By George M. Sinclair, M. Am. Soc. M. E.

We purpose to note some of the general principles controlling the manufacture and use of steel forgings.

The first point to be considered is the design of the forging. Iron forgings are essentially built up, so that it follows that great irregularities of shape are of small moment, so far as the manufacture is concerned. A steel forging, on the other hand, is made from an ingot, which at the outset must be sufficiently large in section to make the largest part of the desired forging out of it. It cannot be enlarged in section except in minor cases, when it may be upset or have a piece welded on. But it is highly objectionable to weld in steel, especially where any strain is put on the weld; and with some grades of steel, welds are altogether out of the question, and even with soft steels, they are undesirable. Cases may be met with, however, in which it is desired to fill out a forging at a point where no stress of importance will come, as, for instance, to form a boss to carry an oil-cup, when a piece of iron or soft steel may be "jumped" on in preference to making a set-down. As a rule, however, avoid all welds. The designer must remember the conditions, which are mainly these: An ingot of practically uniform section to start with, and a material which demands as few heats as possible and does not permit of welds. It follows that he must make his design as simple and uniform as possible, avoiding large collars, arms, sharp set-downs, and other irregularities of form. In return he will get a forging which has been finished in a few heats, at low cost, accurate to size, and giving the machine shop a minimum of work.

The design completed and furnished to the forge master, the billet or ingot is selected, and goes into the heating furnace. What is the condition of an ingot? After being cast it has cooled rapidly from the outside. Since the heat of the interior has passed off through the outer portions of the mass, the interior has necessarily been at a higher temperature than the surface during the entire cooling process, and the more rapid the cooling the greater the difference of temperature between the exterior and interior. The surface has finally set rigidly while the interior was plastic or even fluid. While the interior was still fluid the shrinkage at the lower portion of the ingot is fed from above. Frequently this is at the expense of a hole, or "pipe," at the upper end; but even if the ingot when cooled is solid throughout, the metal is under stress. It is as if a quantity of steel were put in a rigid shell too big for it, and were stretched out in all directions to fill it. Now suppose this rigid shell is expanded by heat so quickly that the heat is not transmitted in any appreciable amount to the interior. It follows that this interior portion must immediately stretch more in every direction, or it will not fill the interior of the shell. So the interior of an ingot is under stress when put into a heating furnace, and these stresses are increased as its exterior is expanded. If the heating is not done slowly, so that before much additional stress is induced, the interior has acquired heat and begun to expand, and the whole ingot is thus gradually brought to a plastic condition, there may be internal cracks in the ingot when it goes to the forge. This danger is not great with small ingots, but large ingots will sometimes crack with a noise like a bell while still almost cold.

To heat slowly, and at the same time economically, requires careful consideration in designing the furnace. Some furnaces under favorable conditions will heat 10 lbs. or even more for 1 lb. of fuel. There are other furnaces in use which do not do better than pound per pound. If very large pieces are to be heated, requiring high temperatures for a long time, the regenerative form of furnace will effect great economy of fuel. If, on the other hand, a great number of small pieces are handled, the furnace might be made long, and the work passed gradually from the cool end to the hot end. This is a form of continuous furnace with many advantages. With any furnace a mild, reducing flame must be kept to avoid "burns" and scaling. The ideal way of heating is to reverse the operation of cooling—that is, heat from the inside outwards. With present appliances this is not possible, except with bored ingots, which are only used for hollow forgings.

In the manufacture of a forging, the forging process itself furnishes the most obvious field for introducing economies and safeguards, and has, therefore, probably received most attention. To change the form of a mass, there must be a flowing of particles over one another against a certain amount of resistance. Time is an essential factor of this flowing. In making a forging, therefore, we have a force acting through space during time, and all three factors, the force, the space and the time, are variable. Bearing in mind these general considerations, a few words on the relative merits of the steam hammer, and the hydraulic forging press will not be out of place. The action of the hammer differs from that of the press mainly in the time effect of the blow. The press differs from the hammer in that, by the intermediary of water and the enlargement of the water passage at the cylinder of the press, we retard the blow and extend its effect over a much greater time.

This being the difference of action of the two systems, which will give a better product? Theoretically, under the press, the particles having ample time to flow, the treatment is not so severe. Practically, however, under a hammer properly proportioned to the work, the particles have then likewise "ample time" to flow. In other words, the press takes a needlessly long time to effect the deformation. Of course we refer only to steel. Other materials may require all the time, or even more, for deformation, which they would have under the press as now constructed. But for steel, the product of the hammer is equal, if not superior, in quality to that of the press. There is, however, a chance for bad practice in the use of hammers which does not exist with presses. A light hammer driven at a high velocity expends its energy on the surface of the forging. The interior not only is not compacted and worked, but it is actually opened up and even ruptured. While hammer forgings can be so made, and may in use have, or soon develop, bad internal cracks, with the press this is impossible; and this fact is a guarantee, to a certain extent, to justify the use of hydraulic pressed forgings.

It is the distinction in the operation of light and heavy hammers, above noted, which has given rise to the prejudice often found against top steam. This prejudice has little foundation, and it would be a mistake to build a hammer for general forging purposes without it. It is the unfortunate property of all steam hammers that the larger the forging, and therefore the greater the power required, the less power is there available, since the large size of the forging reduces the stroke of the hammer. Top steam enables the hammer in effect to lengthen its stroke. That is, it will give the tup at part stroke the same velocity that it would acquire by gravity at full stroke. This gives the hammer vastly greater range without necessarily trespassing on the forbidden ground of high velocities. Further, it increases the product, for a greater number of blows can be given in the same time than with a hammer actuated only by gravity. The use of top steam is legitimate; its abuse must be guarded against.

The advantages of the press over the hammer rest chiefly on merits appealing to the manufacturer of forgings. Except for some varieties of plain work the best designed presses are quicker than hammers, their running expenses are less, and, above all, owing to the absence of shock, they are much more mechanical tools, forgings being turned out from them with precision and ease, which could not possibly be made at a hammer. These advantages can scracely be overestimated. Perhaps the severest criticism brought against the press is the comparatively high heat at which forgings are finished. As all forgings are or should be annealed before being put into use, this criticism has little force.

Whether the forging is made by a press or by a hammer, the virtues or faults of the design must be considered by the hammer man. Before beginning work he must plan it. All reheating, and specially reheating of finished parts, must be avoided. It is time well spent to think out every operation beforehand, to have dimensions calculated, and templets prepared for various critical points of the manufacture, and, in short, so to prepare that almost any contingency which may arise has been foreseen. When a piece is heated and brought to the hammer or press, there is no time for deliberations and consultations. If they become necessary, it is at the expense of the economy and quality of the work.

The forging being made, it remains to "treat" it. The usual treatment is annealing or oil tempering and annealing. Exactly what takes place in a piece of steel submitted to these processes is not certainly known, but the physical results are pretty well understood. In most cases the treatment will consist only of annealing. Formerly the annealing process was a very perfunctory operation, and frequently was omitted altogether. To-day it is generally and rightly regarded as important. All steel comes from the hammer or press with internal stresses more or less severe. The particles are in a disturbed condition, and cannot adjust themselves while the metal is cold; at least, not in a reasonable time. Annealing relieves these stresses. It will also break up crystallization more or less effectively. The effect of annealing is shown by the testing machine by a reduction in tensile strength and increase in extension. To anneal properly, furnaces for the purpose should be used. The old method of burying in lime or ashes, though beneficial, is uncertain and incapable of accurate results. The design of the annealing furnace, like the heating furnace, is capable of much variation, and for best results must be made to suit the peculiarities of each case. The fuel may be wood, coal, gas, or oil. The essential characteristics are, that it shall enable the work being treated to be brought up to any desired temperature slowly and uniformly, and again cooled in the same manner. With these two points provided for, all other devices and arrangements of furnace for facilitating work and for economy may be introduced. For high-class work, the temperatures of the furnace, composition of the metal and physical tests must be noted. In fact, no one at this time can hope to compete for high-grade work without the free use of the chemical laboratory and testing machine, and making and preserving more or less elaborate records.

There is a great variety of other processes by which forgings may be treated, such as case-hardening, Harveyizing, hardening in water, oil-tempering, etc.; but the last mentioned is of more general applicability than any of the others, and we shall close by a reference to it. Its most obvious effect on steels having a moderate percentage of carbon seems to be of a physical character analogous to forging. The sudden contraction due to the chilling of the surface compacts the metal and breaks up crystallization. At the same time the suddenness of the cooling in itself has a tendency to check or prevent the formation of crystals. It is evident from the above, and also from experience, that the thicker the metal the less will be the effect of the oil-tempering, and at no very great thickness the metal in the interior will be little affected. It is also evident that for very irregular shapes the process is not applicable. For cylindrical pieces, and especially for hollow cylinders, it is a most beneficial operation. A coarse crystalline structure is readily changed to a fine homogeneous quality. The most marked effect of oil-tempering and annealing on steel is the raising of the elastic limit. This is accompanied by a moderate gain in tensile strength and a slight loss in ductility; but both these results are secondary in importance, and amount to the effect on the elastic limit. "Gain" and "loss" above are taken with reference to the same steel thoroughly annealed, but not oil-tempered, and also it is to be noted that oil-tempering should, except in particular cases, be followed by annealing.

The application of this treatment is now universally adopted for gun forgings, and has extended from that to large shafting and similar work, and is now also used for armor-plate. The details of tempering, whether double or single, at what temperature, etc., depend on circumstances. In general, the plant necessary consists of a furnace for heating, capable of giving the forging a high uniform temperature, a tank of oil, and proper hoisting and conveying machinery to pass the work quickly from the furnace to the tank. It is to be noted that the heating in this case is of an intermittent character, and the furnace will be designed with that in view. Oil-tempering opens the way for a bad practice which is not always avoided as it should be, and, in fact, is not always recognized as such. We refer to the selection of a very soft steel for the forging and tempering up to fill specifications. This is sometimes carried to such an extent that the final annealing is so slight as to be a farce. While oil-tempering benefits the metal, it leaves it with considerable internal stress which should be relieved by an effective annealing. At the outset, therefore, a sufficiently high grade of steel should be selected to permit of thorough final annealing.

* Condensed from a paper read before the American Society of Mechanical Engineers at the New York meeting.

THE SANITARY PHASE OF THE MERZ GARBAGE PLANT AT ST. LOUIS.

In describing, in our issue of Nov. 1, the construction and operation of the garbage disposal works of the St. Louis Sanitary Co., at St. Louis, Mo., in our article on the Merz garbage utilization system, a letter was included from Dr. George Homan, Health Commissioner, stating that the new plant had been complained of as a nuisance. At a recent meeting of the St. Louis Board of Health Dr. Homan reported on the works in part as follows:

The experience of the past summer, together with a knowledge of the mechanical arrangement and operation of these works, shows that this—(the continuous

air-tight treatment of garbage from start to finish.—Ed.)—is not done, and that but little more has been attempted beyond what its merely commercial needs call for—the important sanitary demands being held rather in abeyance, and this delinquency or negligence has occasioned the nuisance complained of. The evidence offered last summer in personal examinations made at different times by me show the existence of at least two serious gaps or radical flaws in the process there employed, one being the rehandling of raw garbage on the second floor, the other the emptying of the dryers of the contained substance while hot, the material in both instances being exposed to the air and giving off freely its offensive odors, in the latter case at a high temperature, thus aiding its wide diffusion.

In the operation of the works, in attempting to deal with this condition, the rather fantastic practice followed is to first set free the bad smells and then try to recapture them by means of blowers, but the result is failure, and must always be failure. It is my opinion that no exposure of the garbage to the open air is necessary from the time it enters the receiving tanks until it appears as the finished cold products; that the dryers can and should be filled direct from the receivers by steam or other power and that the garbage, when sufficiently freed from moisture, can be subjected to benzine extraction in the dryers themselves, thus avoiding the present necessity of lifting this offensive material from the ground to the top floor, giving off its effluvia all the while. In this position I am supported by the opinions of those whose expert qualifications enable them to speak with authority on this subject. The obnoxious gaps or deficiencies mentioned should be closed at once, as otherwise the nuisance cannot be abated. The company's contract engagement calls for it, the public health demands it, and the fulfillment should be insisted upon.

Much as I regret the necessity for a return to the former way of disposing of kitchen refuse, my opinion is that it would be better to permanently close these works and throw the garbage into the river, than that the people of the southern part of the city should be distressed in future as they have been in the past on this account. But there is no need for this, in my judgment, if the sanitary company is made to live up to its agreement.

The plant at St. Louis is located near a residence section of the city, and has evidently met with opposition from the people living in the south part of St. Louis from the start, as it was stated in our issue of Nov. 1. As it is very important for those cities which are investigating the subject of garbage disposal to know just what may be expected in case a plant is located within a city, we have tried to secure statements from both parties interested, and give below the St. Louis Sanitary Co.'s story of the case as given under date of Nov. 24, after receiving a proof of the previous portion of this article:

Our attention has been called to the letter of Dr. Homan, Health Commissioner of this city, addressed to the Board of Health, commenting upon our factory and about to be published in your paper.

In reply, we would only say that we invite the Engineering News and any other person or persons interested in this question to visit our factory and inspect it thoroughly, as also the surroundings of our factory, and through that inspection judge for themselves whether the works or the vile sewer system in their neighborhood be responsible for the objectionable odors about which complaint is made.

Very truly yours, St. Louis Sanitary Co.

PAPERS ON PUMPING ENGINES BEFORE THE MECHANICAL ENGINEERS.

At the meeting of the American Society of Mechanical Engineers, held in this city last week, three papers on pumping engines were presented, which we give below in slightly condensed form. Two of these relate to tests of pumping engines and one to a change in the suction system of a pump.

Trial of a 10,000,000-Gallon Allis Vertical Triple-Expansion Condensing Pumping Engine at the Water Works at Trenton, N. J.

The test of this engine was made by the authors of the paper, Messrs. Samuel Webber, of Charlestown, N. H., and S. S. Webber, of Trenton, and by Mr. John H. Lewis, as mechanical engineer for the E. P. Allis Co. The Trenton Board of Public Works only wished to know whether the company had fulfilled its contract, and consequently a full duty trial of engines and boilers was not made and the test extended over only eight hours.

The contract requirements of the engine and some details of the test are given below, the facts being condensed from the paper:

The capacity and duty guaranteed by this contract were that the pumping engine should be capable of delivering into the reservoir against a head of 120 ft 10,000,000 gallons every 24 hours, and to do this at a speed of 30 revs. per minute, and show a duty of 125,000,000 ft.-lbs. for every 1,000 lbs. of feed-water pumped into the boilers; steam to be supplied to the engine at a pressure of 110 lbs. per sq. in. No account was to be taken of the fuel consumption; it was, however, decided, for the sake of information, and from a desire to obtain as full data respecting the trial as

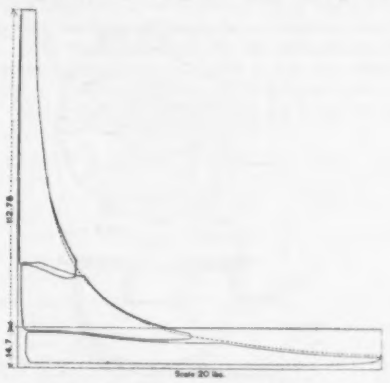


Fig. 1. Combined Diagram from Trenton Pumping Engine.

could be had without special and elaborate preparation, to weigh all fuel used during the test, indicate the engine, take a record of steam temperature and pressure, and test the quality of the steam by calorimeter.

Before beginning the trial it was agreed between the parties in interest to accept the theoretical plunger displacement for the measure of water pumped, making no allowance for slip or leak of valves.

The quality of the steam was tested by a calorimeter at three intervals during the trial, and gave precisely the same readings, the result showing a percentage of moisture in the steam of 1.25%.

All the cylinders and receivers are steam-jacketed. The amount of steam condensed in the jackets was not measured, hence no expression of the value of these jackets can be given from the trial. It would seem, however, from the high duty obtained, that the jackets were a factor of economy.

The valve gear is of the usual Corliss type, with Reynolds improvements. In general design, though of less capacity, the engine is similar to those built by the Allis Co. for Chicago and Milwaukee.*

The steam cylinders have diameters of 20½, 36 and 52 ins., the water plungers are 25¼ ins. in

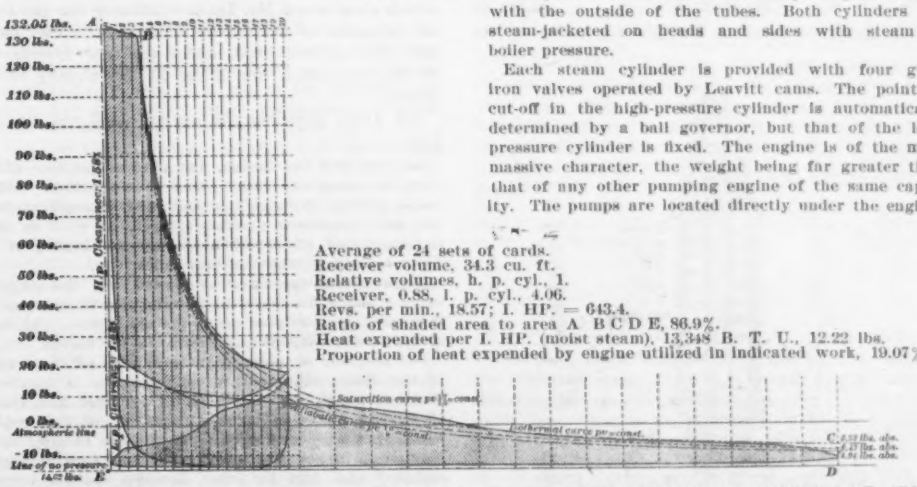

132.05 lbs.
130 lbs.
120 lbs.
110 lbs.
100 lbs.
90 lbs.
80 lbs.
70 lbs.
60 lbs.
50 lbs.
40 lbs.
30 lbs.
20 lbs.
10 lbs.
0 lbs.
Atmospheric line
-10 lbs.
Line of no pressure
14.62 lbs.
Saturation curve per lb.-cond.
Adiabatic curve per lb.-cond.
Isothermal curve per cond.
Average of 24 sets of cards.
Receiver volume, 34.3 cu. ft.
Relative volumes, h. p. cyl., 1.
Receiver, 0.88, l. p. cyl., 4.06.
Revs. per min., 18.57; I. HP. = 643.4.
Ratio of shaded area to area A B C D E, 86.9%.
Heat expended per I. HP. (moist steam), 13,348 B. T. U., 12.22 lbs.
Proportion of heat expended by engine utilized in indicated work, 19.07%.

FIG. 2. COMBINED DIAGRAM FROM LEAVITT PUMPING ENGINE AT LOUISVILLE, KY

diameter, all with a 36-in. stroke. The cylinder clearances are 2.05% for the high, 1.97% for the intermediate and 1.9% for the low-pressure. The total plunger displacement per stroke is 234.11 gallons.

The water was fed to the boilers at 59° F., no heater being used, and the average steam pressure was 112.27 lbs. A head of 119.62 ft. was pumped against.

The results showed a pumpage, under the terms of the contract of 10,113,680 gallons in 24 hours, and a duty, in the terms of the contract, of 133,856,000 ft.-lbs. per 1,000 lbs. of feed water.

*Described in Dr. R. H. Thurston's paper "On the Maximum Contemporary Economy of the High-Pressure Multiple-Expansion Steam Engine," Trans. Am. Soc. M. E., vol. XV.

The paper is concluded as follows:

The results show a very high efficiency for a triple engine working with so low an initial pressure as 112 lbs. of steam; and had the vacuum obtained been better, the results would have been correspondingly increased. For some cause, which at the time of trial could not be ascertained, the vacuum did not go below 12.5 lbs., and the average throughout the trial was 12 lbs.; it should have been 13.5 lbs. at least for an average. The indicator cards show a fairly even distribution of power; the intermediate cylinder not showing its proportionate share of the work as compared with that of the high or low-pressure cylinders. The combined diagram, Fig. 1, shows a close agreement in the expansion lines with the hyperbolic curve. The clearances are small, due to placing the Corliss valves in the cylinder heads instead of at the ends of the cylinder castings, as is the usual practice. If the initial pressure had been 125 lbs., as in the case of the engines at Chicago and Milwaukee, and a more perfect vacuum had been obtained, the efficiency of the engine at Trenton would, no doubt, quite equal that recorded for the engines above mentioned; possibly the higher head, under which these engines pumped, contributed to very high duty shown by them as compared with that given in this report. All things considered, the Allis engine at Trenton is certainly one of the best examples of the modern high-duty pumping engine.

Trial of a Leavitt Pumping Engine at Louisville.

This paper was written by Mr. F. W. Dean, M. Am. Soc. M. E., who with Mr. Dexter Brackett, M. Am. Soc. C. E., tested the Leavitt engine at Louisville, last April, Mr. Dean representing the Louisville Water Co., for whom the engine was built, and Mr. Brackett, the builders, the I. P. Morris Co., of Philadelphia.* The test lasted six days, the engine running 144 hours 10 minutes without stop, which Mr. Dean says is the longest test run on record. Mr. Dean also says the test shows this to be the most economical compound engine ever tested, so far as he knows.

The paper deals only with the results of the test of the steam end of the engine. Mr. Dean describes the engine and its test as follows:

It is of the well-known Leavitt type, having two vertical inverted cylinders, the piston rod of the high-pressure cylinders being connected by links to one end of a beam, and the low-pressure similarly to the other end of the beam. The main shaft is at one end of the engine, and the connecting rod passes from a pin in the upper part of the beam to the crank-pin. The steam pistons have opposite motions in consequence of this arrangement, and the exhausts from the ends of the high-pressure cylinder pass to the corresponding ends of the low-pressure cylinder. There are two reheating receivers between the cylinders composed of small brass tubes, inside of which is live steam of boiler pressure, the exhaust steam passing in contact with the outside of the tubes. Both cylinders are steam-jacketed on heads and sides with steam of boiler pressure.

Each steam cylinder is provided with four grid-iron valves operated by Leavitt cams. The point of cut-off in the high-pressure cylinder is automatically determined by a ball governor, but that of the low-pressure cylinder is fixed. The engine is of the most massive character, the weight being far greater than that of any other pumping engine of the same capacity. The pumps are located directly under the engine, and the plungers are connected to the beam at such points that, while the stroke of each steam piston is 10 ft., that of each pump plunger is 7 ft. The plungers work vertically and are of the differential type, being single-acting on the suction, and double acting on the discharge. The engine is provided with a surface condenser and vertical double-acting air-pump.

On account of the rise and fall of the Ohio River the bed-plate of the engine is placed above the highest high-water mark, while the bottoms of the pumps are sufficiently low to take water at the lowest stages of the river. The distance from the bottoms of the pumps to the bottom of the bed-plate is 61 ft.

The trial consisted of ascertaining the duty by weir

*According to the report of the Louisville Water Co., for 1893, this engine has a contract capacity of 16,000,000 gallons, and was designed by Mr. E. D. Leavitt, M. Am. Soc. M. E., M. Am. Soc. C. E., and Mr. Chas. Hermany, M. Am. Soc. C. E.—Ed.

measurement at the reservoir, and nearly or quite all other data of interest. That part of the trial relating to the engine only will be here described. The engine is worked by steam of 140 lbs. gage pressure at the boilers, and this is conducted through 180 ft. of steam pipe, well covered, to the engine. At the engine the total condensation in this pipe and priming of the boilers amounted to 2.58%, and all of this but 0.55% was thrown out by a separator. The steam pressure at the engine near the high-pressure cylinder fell to 137 lbs. by gage.

At the beginning of the trial the steam pressure in the two boilers used was at about 90 lbs., and just before starting the engine the water level was marked in both boilers. Immediately after stopping the engine, 6 days 10 minutes later, the same pressure and water levels existed.

Indicator diagrams were taken every hour throughout the 144 hours on separate indicators at each end of each cylinder. These diagrams were taken with great care, and after the trial the scales of the indicator springs were determined at the Brooklyn Navy Yard.

Before the trial the engine had been run the greater part of a year. The piping and cylinders were thoroughly covered with a non-conductor of heat.

The diameters of the engine cylinders when hot were 27.21 ins. for the high and 54.13 ins. for the low-pressure. The flywheel is 36 ft. in diameter and each piston has a 10-ft. stroke. The clearances are 1,585% for the high and 1.53% for the low-pressure cylinder. The differential plungers are 34 and 24 1-16 ins. in diameter and their stroke 7 ft. The average piston speed was 371.48 ft., and the plunger speed 260.04 ft. per minute. The average steam pressure was 140 lbs. at the boiler and 137 lbs. at the engine.

The prevailing point of cut-off in the cylinders was 20.2% for the high and 42.1% for the low pressure. The compression was full for the high and five-eighths for the low pressure cylinder. The efficiency of the mechanism, in point of average power, was 93.12%. The duties based on the plunger work were as follows:

	Foot-pounds.
Plunger work performed in 144 hrs. 10 min.	171,015,314,000
Duty per 1,000,000 B. T. U. used by engine alone	138,126,000
Duty per 1,000 lbs. moist steam used by engine alone	150,838,000
Duty per 1,000 lbs. dry steam used by engine alone	151,672,000
Duty per 100 lbs. Pittsburg coal	125,444,000
" " 100 " Pocahontas coal	139,031,000
" " 100 " Pittsburg combustible	129,295,000
" " 100 " Pocahontas "	145,762,000

A combined diagram for this engine, being the

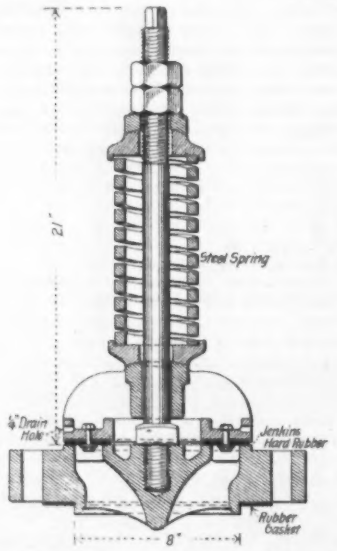


Fig. 3. Relief Valve for Suction Main of Taunton Engine.

average of 24 sets of cards taken between 3 p. m., April 29, and 2 p. m. April 30, 1894, is shown by Fig. 2.

Mr. Dean concludes his paper as follows:

It is the writer's opinion that in order to use steam in the most economical manner in a multiple expansion engine, the expansion must be continuous throughout the series of cylinders (that is to say, there should be no drop between the cylinders), and that compression should be carried up to the initial pressure in each cylinder. These features have been employed to the fullest extent in the Leavitt engine which forms the subject of this paper, and the result has surpassed all records for economy of engines of its class.

Changing the Suction System of a Pumping Engine, at Taunton, Mass.

The city of Taunton has been supplied with water from wells for a number of years, all the supply being pumped with a suction lift of 21 ft. Recently a supply was introduced from ponds some

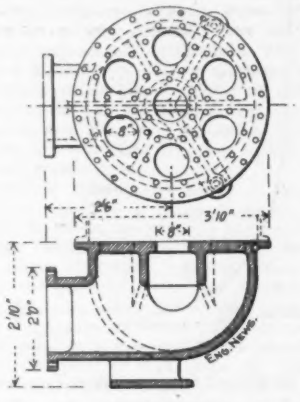


Fig. 4. Base for Relief Valve Chamber.

seven miles distant, through a 30-in. gravity main, giving a pressure of 30 lbs. at the engines, and it was desired to utilize this pressure to lighten the load on the engines by connecting the new main with the suction of the 4,000,000-gallon Gaskill pump. The new supply was introduced with Mr. Desmond Fitz Gerald, M. Am. Soc. C. E., as engineer, and he requested Mr. F. W. Dean, M. Am. Soc. M. E., to design a suction system by which this head could be used or the old supply could be drawn upon at will. Mr. Dean described this work in a paper with the title given above.

The Gaskill engine has a 16-in. high and 32-in. low pressure cylinder and an 18-in. plunger, all of 28-in. stroke. When working under domestic pressure the pump makes from 7 to 15 revs. per minute and under fire pressure, from 10 to 25, to which slow speed Mr. Dean attributes the successful operation of the valves when using either supply. The suction head, under the new system, is 69 ft., as against the lift of 21 ft., already mentioned.

Mr. Dean describes the method employed as follows:

In preparing the design, the obvious possible difficulty of using the same pump valves without additional springs or weights to seat them promptly under the new conditions presented itself, as well as the importance of effectively absorbing the inertia of a 30-in. column of water several miles long.

When the change was completed and the engine started under the head, to the surprise of everybody it worked as quietly as under the old system, and has so continued, without any change in the valves.

The methods of absorbing the inertia of the surge of the 30-in. column of water were two in number. There is an air chamber 4 ft. in diameter and some 15 ft. high placed over the extreme end of the supply main, that was considered ample in size to meet any fluctuation in pressure, provided it was kept properly supplied with air. In order, however, to avoid any rupture or dislodgment of parts when the air chamber is improperly filled, seven 6-in. spring relief valves, wholly of composition, except the springs, were designed to allow the water to escape to waste when the pressure reached a prescribed maximum. While these valves cannot provide the elasticity which is desirable in handling water, and which the air chamber amply supplies, they limit the pressure to which this water can rise when any unusual surge occurs. The occasions of such occurrences are sometimes when reducing the speed of the engine from fire to domestic service. The valves are set to lift at 40 lbs. per sq. in., and they successfully limit the water pressure to that amount.

The relief valves are made with a spherical-jointed spindle and nut, as shown in the engraving, in order to allow them to seat squarely if the springs should tend to incline them. They are grouped on a bowl-shaped casting covered by a light cast iron cover, from which the waste pipe passes, as shown by Fig. 4.

When the old system is used, the air chamber becomes a vacuum chamber, and takes the place of one furnished originally.

The waste water from the relief valves is conducted to the old pump well, and the fall of the water into the well forms an audible tell-tale of their operation.

PAPERS ON STEAM ENGINEERING BEFORE THE MECHANICAL ENGINEERS.

Of the 26 papers read at the annual convention of the American Society of Mechanical Engineers, held last week in this city, 13 were on the general topic of steam engineering. Three of these, which refer especially to pumping engines, are abstracted in a separate article on another page of this issue. The remaining papers on this subject are abstracted below:

Results of Measurements to Test the Accuracy of Small Throttling Calorimeters.

This paper by Prof. D. S. Jacobus described tests made by the author and Prof. J. B. Denton, at Stevens Institute, to determine how reliable are the tests of percentage of moisture in steam afforded by small throttling calorimeters. The tests showed in general that the indications of these instruments may be highly misleading. The great difficulty appears to be to get a fair sample of the steam that is flowing through a pipe. The ordinary method of projecting a small tube with its end closed and its sides perforated with small holes into the pipe in which steam in flowing, gives highly misleading results. The results of the test are shown in the following table:

Comparison of Actual Percentages of Moisture with Amounts Indicated by a Throttling Calorimeter; Steam Passing Through a 3-in. Horizontal Pipe.

Character of nozzle.	Steam passing through pipe per hour, including moisture, lbs	Pressure of steam, lbs. per sq. in.	% of moisture by Barrus calorimeter.	% of moist. by weigh'g water injected into steam pipe.
Vertical with 12 holes 7-32 in. diam.	1,698	80	5.5	2.5
	1,877	80	9.3	3.3
	1,768	80	11.1	4.7
	1,788	80	20.9	10.9
	2,003	80	31.8	19.1
	2,381	80	47.9	36.5
Vertical with 12 holes ⅛ in. diam.	1,916	78.5	54.6*	21.0
	2,044	78.9	50.8*	17.6
Horizontal, 6 holes 7-32 in. diam.	1,578	80	6.3	2.3
	1,,58	80	8.4	3.2
	1,525	80	14.6	8.8
	1,637	80	17.8	10.1
	1,745	80	37.4	23.0
	2,187	80	46.9	37.2
Nozzle with slot away from current.	1,577	80	5.6	1.0
" " " toward "	1,576	80	0.1	1.4
Nozzle, slot right angles to current.	1,578	80	2.5	1.2

*In these tests the calorimeter was not attached to the same horizontal pipe as in the others, and the conditions were such that it is probable that moisture ran along the bottom of the pipe and entered the lower holes of the nozzle.

The paper described fully the method employed to obtain a mixture of steam and water of known quality on which to test the calorimeter; but this we omit, as there appears no reason to doubt its correctness. The lesson to be drawn from the paper and the discussion upon it in connection with facts before put on record, is that it is well to take statements of the percentage of moisture shown in a boiler test as probabilities and not as certainties, especially if any abnormal result is shown.

Stresses in the Rims and Rim Joints of Pulleys and Flywheels.

This paper by Prof. Gaetano Lanza, of the Massachusetts Institute of Technology, although bristling with mathematics, was really an important contribution to the subject of flywheel stresses and ought to receive careful consideration by the builders of engines, and by engineers drawing specifications. The fact of especial interest pointed out by Prof. Lanza is that in large built-up flywheels, as ordinarily designed, the joints in the rim are subjected to a bending strain which will cause their failure long before they would break under ordinary tensile strain. For this reason the bolts in the joint should be placed as close to the rim as possible and should be proportioned for the bending stress which they have to sustain.

Experiments on a System of Governing by Compression.

It is familiar knowledge that with both the throttling governor engine and the automatic cut-off engine, the work done in the cylinder is varied by varying the amount of steam admitted to the cylinder. Many engineers have proposed to regulate the engine from the opposite end, and vary the mean effective pressure to suit the load by varying the compression on the exhaust side of the piston. In the paper with the above title Prof. John H. Barr, of Cornell University, described a series of experiments to test the virtues of this method of governing, which were recently carried out at Cornell University. The high-pressure cylinder of the Reynolds-Corliss engine, at Sibley College, 9×36 ins., was used for the test. The tests are summarized in the accompanying table:

	Net load on brake lever.					
	104 lbs.			216 lbs.		
	Compression governing.	Cut-off gov.	Comp. gov.	Cut-off gov.		
Mean steam pressure	109.5	107.0	111.5	113.8	110.6	113.3
Mean revs. per min.	83.45	83.46	83.45	86.69	81.75	85.95
Steam per hour, lbs.	616.0	611.6	604.0	575.7	880.3	780.8
Indicated HP.	12.86	13.90	13.98	13.10	24.84	24.53
Delivered HP.	10.87	10.87	10.87	11.29	22.10	23.24
Steam pr I. HP., pr. hr.	48.00	43.90	43.20	43.95	35.80	31.83
Mech. efficiency, %	84.53	78.20	77.8	86.2	88.98	94.74

It will be seen that the steam consumption per horse-power was about the same for the compression governing as for the cut-off governing. The mechanical efficiency of the engine was lower, probably on account of the increased pressure on the bearings when the crank is near the dead center. The author sums up the results of his work as follows:

While it is decidedly unsafe to draw conclusions from such limited data, these few trials indicate, as far as they go, that, whatever the possible gain from using compression as a method of governing may be, it will probably prove effective in ameliorating the wastes of the steam engine only to a limited degree, under ordinary circumstances.

There are two conditions under which it is possible that the compression method of governing may yet prove advantageous to some extent: First, with steam pressure so low that the ordinary distribution gives a large loop at the end of expansion with light load, and, secondly, with compound engines.

The Effect of Clearance on the Economy of a Small Steam Engine.

This paper described experiments by Prof. G. W. Bissell, of the Iowa Agricultural College, to test the effect of a varying amount of a clearance upon the economy of a small throttling slide valve steam engine, with cylinder 4½×9 ins. The clearance was varied from 8.02% to 19.41%. The paper was 44 pages long and the sole conclusion which the author drew from these extended tests was that "for this engine the maximum economy at all loads was obtained at an economy of about 14½%, and that the economy increases with the load, although not in direct proportion." The printing of this paper in the proceedings appear to be a waste of the Society's money.

Tests on the Triple-Expansion Engine at the Massachusetts Institute of Technology.

This paper, by Prof. C. H. Peabody and Prof. E. A. Miller, presented additional results obtained in tests on the experimental engine in the laboratories of the above school. The following quotation comprises all that we find of any practical value in the paper:

If we assume the minimum heat consumption without jackets to occur with the cut-off on the high-pressure cylinder at 30%, and to be 270 B. T. U. per HP. per minute, we may make provisional comparisons with the consumptions with steam in the jackets on the heads, or with steam in the jackets on heads and barrels.

The ratio of the heat consumptions with steam in all the jackets and without steam in the jackets is:

233 : 270 :: 1 : 1.16.

The ratio of the heat consumptions with steam in the jackets on the heads and without steam in the jackets is:

262 : 270 :: 1 : 1.03.

It is our opinion that the heat consumption of this engine is really larger than 270 B. T. U. per HP. per minute, and that the gain from the use of steam in the jackets is larger than is shown by the preceding ratios, to the extent of 1 or 2%.

Two remarkable and to us unexpected conclusions appear to come from our tests on jacketing: (1) that there is comparatively little effect from jacketing the heads of the cylinders of our engine; (2) that the gain from jacketing is less for very short cut-off than for a cut-off at 30% on the high-pressure cylinder, at which our engine finds its minimum consumption.

Trials of a Recent Compound Engine with a Cylinder Ratio of 7 to 1.

In this paper Mr. F. W. Dean, of Boston, described a test made on an engine built on what is known as the Rockwood system. Mr. Rockwood, the inventor of this system, claims that by it he can generate a horse-power in a compound engine with as little steam as in a triple-expansion engine. The main features of the system are a large ratio between the volumes of the two cylinders and a considerable drop in pressure between them. The substance of Mr. Dean's paper is as follows:

This engine was built by the Wheelock Engine Co., of Worcester, Mass., for B. B. & R. Knight, of Providence, R. I., and located at their mill in Natick, R. I. The engine possessed the cylinder ratio of 7 to 1, which, under the Rockwood system, is held to possess special virtue.

The following are the leading dimensions:

Diameter high-pressure cylinder, hot	18.44 ins.
" low-pressure " "	48.50 "
Stroke of both pistons	48.00 "
Mean ratio of piston areas	7 to 1
" high-pressure clearance	2¾ %
" low pressure "	2½ %

The engine is a horizontal cross-compound, with the high-pressure cylinder jacketed all over, and the low-pressure cylinder on the heads only. There was a reheater between the cylinders. In the writer's judgment the jackets were badly piped, and it is doubtful if the jacket circulation was good. The reheater was quite deficient in heating surface. The condenser was of the injector type, made by the builder of the engine. The vacuum was defective, although very cold water was used.

The following is a brief tabulation of the results:

	—1894.— Jan. 26, p. m.	Jan. 27, a. m.
Duration of trials, hours	4½	5
Ave. steam pressure near engine, lbs.	159	158
" vacuum, ins.	25.4	25.2
" ratio of expansion by volumes	33.0	33.4
" No. of revs. per min.	76.357	75.003
" piston speed, ft. per min.	610.86	612.82
P. c. moisture in steam near cylinder	1.90	1.75
Total dry steam used, lbs.	34.089	37.677
Average I. HP.	594.79	582.21
Dry steam used per I. HP. per hour	12.74	12.94
Av. dry steam used per I.HP.per hr., lbs.	12.84	

It will be seen that these results show a very economical use of steam, and far less than has heretofore been thought possible with compound engines. If the vacuum had been 28 ins., the steam consumption might have been as low as 12.36 lbs. on Jan. 26, p. m., and 12.60 lbs. on Jan. 27, a. m., if this had not given rise to any unfavorable set of thermodynamic conditions. The average of these two is 12.48 lbs.

The indicator diagrams showed a considerable drop in pressure between the cylinders. The writer is aware that this is desired by the designers, but the loss in effect of the steam to which this gives rise cannot be recovered by any subsequent event. Moreover, this drop exaggerates the difference in the ranges of temperatures of the two cylinders, and increases the loss still further by increasing the cylinder condensation, according to the well-known and fundamental theory of the desirability of equal ranges of temperatures. The ranges on Jan. 27 were about 144° in the h. p. and 82° in the l.-p. cylinder.

Although the performance of the engine is remarkably good, the writer believes that it was realized in spite of great defects, and that it would have been much better if these alleged defects had not existed. The economy, in the writer's judgment, is due to high steam pressure with the resultant high degree of expansion, small clearances, and tight pistons and valves.

The New Porter Steam Engine.

Reference has before been made in these columns to the new steam engine which is being developed by Mr. Chas. T. Porter, and which is regarded with so much interest, on account of Mr. Porter's work in steam engineering, in his early days. Mr. Porter read four papers at the meeting describing this engine and its appendages, and comparing the action of a fixed cut-off and throttling governor, with which this engine is equipped, with the action of an automatic cut-off valve, with reference to economical working.

Mr. Porter's engine is chiefly notable in its mechanism for controlling the steam. In the first place, the cylinder is entirely surrounded by a jacket through which the steam passes to enter the cylinder, and which also acts as a separator, to remove entrained water. The engine has a fixed cut-off and is adjusted to its load by a new form of frictionless throttling governor. The valve is moved by a cam designed to give the best possible steam distribution. The valve itself is of the piston type, but is designed to reduce the waste room to the lowest possible amount. The papers of Mr. Porter discuss a large number of questions of much interest to steam engine designers, but at a length too great to permit their reprinting here. Mr. Porter reported no results of tests with his engines, but expressed his belief that an engine could be built on the principles he had laid down, which would give a horse-power per hour for 10 lbs. of steam.

PAPERS ON RAILWAY ENGINEERING BEFORE THE MECHANICAL ENGINEERS.

Among the papers presented at the annual meeting of the American Society of Mechanical Engineers, held in New York last week, were five concerning matters of especial interest to railway mechanical officers. Two of these, on locomotive counter-balancing, we shall take up in a later issue, and the matter of chief interest in the remaining three is given in the following abstracts:

The Application of Brakes to the Truck Wheels of a Locomotive.

In the paper by Prof. Gaetano Lanza, of the Massachusetts Institute of Technology, were described experiments on trains hauled by an engine fitted with brakes on the truck. The engine was an Old Colony R. R. locomotive of the eight-wheel type, with cylinders 18×24 ins., driving wheels 5 ft. 6 ins., diameter and weights as follows:

Weight on driving wheels	63,000 lbs.
" on truck	35,000 "
Total weight of engine	98,000 "
Total weight of tender, loaded	64,000 "

The cars used were 50-ft. passenger cars, having an average weight of 43,000 lbs. The objects of the experiments were to determine the following: 1, the distance in which the train could be stopped with the truck brakes applied, as compared with that in which it could be stopped when the truck brakes were not applied, every wheel in the train having brakes acting on it; 2, the distance in which the train could be stopped with all brakes applied and the throttle closed, as compared with that in which it could be stopped when all brakes were applied and the throttle was left open. The tests were made on a straight and level track. Tests were made with the engine running light and also hauling one to six cars. The gain in percentage of length of stop when using truck brakes over the length when not using them was from 3 to 23%, according to weight of train and speed, as shown by the following condensed table:

No. of cars.	Speed m. p. h.	—Length of stop, ft.— Tr. brk. in.	Tr. brk. out.	Diff. ft.	Gain, p. ct. with tr. brk.
0	60	1,657	2,149	492	23
0	45	1,005	1,292	287	22
1	45	855	962	107	11
3	60	1,203	1,314	111	8
6	60	1,217	1,251	34	3
6	45	741	780	39	5

The gain in percentage of length of stop when the throttle was closed over the length when throttle was open, the truck brakes being used in each case, ranged from 10% to 21%, as shown below:

No. of cars.	Speed m. p. h.	—Length of stop, ft.— Throt. opn.	Throt. cl.	Diff. ft.	Gain, p. ct. with throt. cl.
4	45	1,033	818	215	21
4	60	1,679	1,432	247	14
6	45	826	741	85	10

A Graphical Method of Designing Springs.

The author of this paper, Mr. Geo. R. Henderson, of Roanoke, Va., Chief Draftsman of the Norfolk & Western R. R., called attention to the value of Prof. Durand's logarithmic cross-section paper (Eng. News, Sept. 28, 1893), for rapidly solving equations containing variables affected with various indices. He had made especial use of this paper for solving problems in connection with the design of springs. While some of the formulas for springs are simple, yet, as they contain several variable and different powers, much time is often consumed in determining the most advantageous proportions for the purpose required, and the author, having much spring designing to do, laid out a few

simple diagrams which greatly facilitate the calculations of proportions of new springs, and the properties of springs whose proportions are known. Comparison of actual tests of deflection with results found by the diagrams show a very close approximation.

The Strength of Railway Car Axles.

This was a valuable paper by Prof. L. S. Randolph, of Blacksburg, Va., giving some calculations of strains upon the axles of freight cars. The total weight of a 60,000-lb. car, with 27,000 lbs. dead load, is 87,000 lbs., or deducting 6,800 lbs. for 8 wheels and 4 axles, gives a weight of 80,200 lbs. on the journals, which equals 10,000 lbs. per journal. This is constant, and may be taken as the minimum static load on the journal. This load, while acting constantly, would be of the nature of

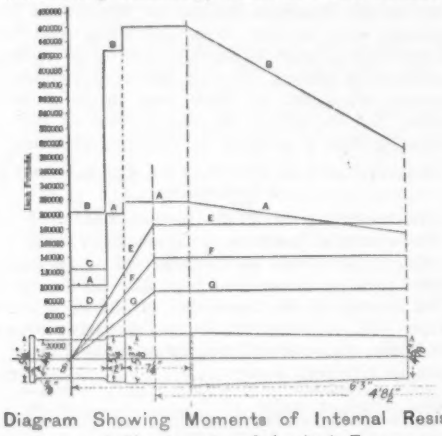


Diagram Showing Moments of Internal Resistance, and Movements of Applied Forces on a Railway Car Axle.

an intermittent or repeated load, the load being applied first in one direction, as regards any one set of extreme fibers, and then in the other.

The experiments of Woehler and Spangenburg give for the ultimate strength, under these conditions, 17,000 lbs. for wrought iron, 30,800 lbs. for Krupp's axle steel. Taking the safe number of vibrations at 30,000,000, we find that a 33-in. wheel under a freight car, with an average of 30 miles per day, would make about 6,720,000 revolutions, or would be worn out in about five years, if the metal was strained to the limits given.

The springs used by a number of our railways are so arranged that the deflection under the static load is about half the total deflection. The writer has observed a number of these springs which have been forced solid. This would give a load, when the spring was thus forced down until the coils touched, of 20,000 lbs. What the load would become when the oscillations were more than enough to force the spring solid, it would be impossible to say. The writer's observations have shown that the springs are constantly deflected to a point midway between the loaded and solid height, giving a load of 15,000 lbs. on the journal.

The centrifugal force of a freight car on a 6° curve, at 20 miles per hour, would be about 300 lbs. for the pressure on the flange. Schiffler gives as the results of his experiments that the oscillations may give a horizontal component of 40% of the static load; this would give about the same figure as above, namely, 15,000 lbs., and would be much greater than that due to the centrifugal force. This would give the loads on the journals as follows: Static load, 10,000 lbs.; load repeatedly occurring, 15,000 lbs.; load with springs solid, 20,000 lbs.

The movements of these applied loads would follow the lines shown on the diagram. Lines A and B give the moment of resistance for stresses of 18,000 and 30,000 lbs. per sq. in.; C and D give the moments for similar stresses when the journal is worn down to the limit of 3½ ins., while E, F and G give the moments of the applied forces for loads of 20,000, 15,000 and 10,000 lbs. respectively on the journal. The calculations of a large number of broken axles have indicated, though not definitely proved, that when the moment of resistance approached the moment of the applied forces, breakages became very frequent. The fractures in a large number of axle breakages examined have been where the wheel-seat joins the tapered portion of the axle, and were, undoubtedly, due to the scoring of the axle at that point by the tool. The others were about evenly divided between the center of the axles and the junction of the journal with the axle, indicating weakness at these points, and it will be noticed that the lines of the moments of applied forces approach more nearly to the lines of the moments of resistance at these points.

The only cases of breakage in the tapered portion between the wheel-seat and the center of the axle, which have been observed by the writer, have invariably been due to flaws in the material, and they have been very few in number. It will be noticed that the lines of the moments of applied forces are horizontal between wheel-seats, which would indicate that the axle should be made the same diameter in the center as at the wheel-seat. The observations above, on breakage of axles, also lead to the same conclusion. The author believes that the vertical load may be increased 100% by vertical oscillations, and that such oscillations are greater than the horizontal ones, and should, therefore, govern the design of the axle, though this has not been definitely settled. The paper concluded as follows:

A majority of the steel axles made to-day are accepted on the result of the drop test, which test can be passed most successfully by the mildest or softest grades of steel axles, and these are certainly below the 85,000 lbs. tensile strength of the axle steel tested by Woehler, and must consequently give less resistance to repeated loading.

The question of the durability, or number of repeated loadings which the material will stand, is one on which very little real information is obtainable. The writer has taken 30,000,000 repetitions as the number required to break the axle when under the ultimate stresses allowed for repeated loading, but there is very great uncertainty about the matter.

There are two methods of determining the life of an axle; one by the mileage, and, consequently, by the number of revolutions made; the second by the wear of the journal. The first would give a very accurate method of determining the life of an axle. The method by allowing the axle to wear down to a given limit, 3½ ins. diameter for the journal of the axle shown in the diagram, gives widely ranging figures.

When the lubrication is well done and there is little wear, the axle may be allowed to run very much longer than it should. When the journal wears rapidly, the axle is thrown out of service long before it is worn out, and while the journal may be fully strong enough to stand the load. The most important deduction which the writer has been able to draw from this examination of the strength of axles, is the need of a series of experiments in this country, on the effect of repeated loading on iron and steel, especially with respect to the durability under the different loads.

STRAIGHTENING A LEANING CHIMNEY 100 FT. HIGH.*

By Joseph C. Platt, M. Am. Soc. M. E.

The chimney of the Ormsby Textile Co., of Waterford, N. Y., was erected in 1893. Soon after its completion it was found to be considerably out of plumb, and when first measured, in November, was found to lean about 16 ins., and a few days later 22 ins. Then the rate of increase of inclination became less, but in March, 1894, it was 28⅛ ins. out of line, and it was decided to attempt to straighten it.

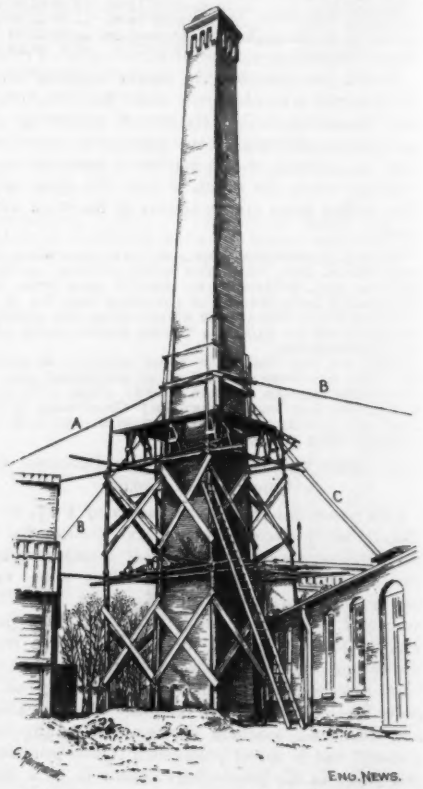
The chimney proper is rectangular in plan, is built of brick, is 9½ ft. square at the bottom and 5½ ft. square at the top; it is 100 ft. high and has a central flue 3 ft. square. The estimated weight is 200 tons. It stands upon a foundation 14 ft. deep, the tower 4 ft. being of concrete about 14 ft. square, on which rests heavy stonework 10 ft. high, 14 ft. square at the bottom, and 9 ft. square at the top. The weight of the foundation is about 149 tons, making a total of 355 tons resting on 196 sq. ft., about 1.8 tons per sq. ft.

Before commencing the work soundings were made on all sides of the proposed site. These varied from 20 to 38 ft. in depth below the natural surface of the ground, and indicated the same character of soil as its surface, a soft, alluvial deposit, with streaks of sand, but with no hard material or rock or bowlders. The chimney was built upon this soil without the use of any piles. Two similar chimneys had been built in the immediate vicinity on what appeared to be similar material, and no trouble had been experienced with these. The bottom of the concrete is about 2 ft. above normal summer level of the Mohawk River, but at the time of sounding in March it was submerged about 4 ft., it being found that the water rises and falls in the soil in the vicinity with the rise and fall of the river.

The work of straightening the chimney commenced on March 19, 1894. A scaffold was erected about the chimney, and eight oak timbers 6 × 10 ins. by 10 ft. were placed vertically at the corners at a height of 42 ft. above the stonework and 4½ ft. below the center of gravity of the brickwork; the object of the oak timbers being to spread the bearing of the wire ropes over as large a section as practicable.

Wire ropes were passed around the timbers, and another wire rope, 2½ ins. in diameter, with an eye in each end, was fastened to the first-mentioned ropes at its upper eye. The lower eye was connected with a system of pulleys secured to the dock at the river edge at a point 78 ft. distant and directly opposite the direction in which the chimney leaned, the pulleys being made up of three sets of double and single blocks connected together in series, having three points of fastening to the dock, and having eleven pulleys in the system. Cables were also put out from the chimney on each side at right angles to the main cable, and having turn-buckles to tighten them; also a guard cable in rear.

The earth was then excavated on the high side of



Straightening a Leaning Chimney 100 ft. High.

the foundation nearly half way around to the bottom of the foundation (a depth of 13 ft.) and the main cable put under strain with the pulleys. By this means, in the course of three weeks, the chimney was brought back about 4 ins. Then, with a post-hole digger 8 ins. in diameter, eleven holes were sunk vertically in the bottom of the trench around the fountion, principally at the highest point, to a depth of 5½ to 6 ft. At this time the water in the river stood up to within 1½ ft. of the bottom of the foundation, the ground being soft to a depth of 4 ft.; it then became very hard, showing that the strata supporting the chimney had been reached. No movement or flow of the soil was discovered until the eighth hole was sunk 4½ ft., and the tool withdrawn for clearance, when it could only be reinserted readily about 3 ft. and headway made very slowly.

From this removal of the earth there resulted, within a few hours, a righting of the chimney to the extent of 5 ins. This increased to 8 ins. by the next morning. The slack of the pulling rope was taken up as fast as the chimney moved, and the rope was kept under strain. By tightening up the pulley rope two or three times daily, in a week the chimney was brought back to 8¾ ins.

At this point, in a similar manner, the post-hole diggers being reduced to 6 ins. in diameter, about one-fifth as much more material was removed, immediately followed by righting the chimney to 4 ins., and from that point, after filling the holes with fine broken stone and gravel thoroughly rammed, by con-

* Condensed from a paper read at the New York Meeting of the American Society of Mechanical Engineers.

tinued daily strain on the main cable, the chimney was brought back to plumb at the rate of ¼ in. per day. The turn-buckles in the side cables were occasionally used to control any tendency toward lateral inclination.

The work has been accomplished without injury to the structure. Time alone can tell whether it will permanently retain its position. It is stated that some chimneys in Louisville, Ky., which were straightened in a similar manner, have remained in proper position. This chimney settled in all 0.598 ft.

The work was done under the direction of the owners, by a local contractor, following methods proposed by A. T. Sabin, C. E., of the Chesapeake, Ohio & Southwestern R. R. Co., who had knowledge of how similar work had been done near Louisville.

The work was completed in May, 1894, and in September, 1894, the chimney leaned nearly 2 ins. toward the river, and away from the mill. This inclination has come since the trench was filled, and is, perhaps, the result of the weight of the material which filled the excavation on the high side of the foundation. This excavation was so large and deep that the material used to fill it probably weighed 80 tons.

PERSONALS.

Mr. George A. Mowle, contractor, was drowned at Little Rock, Ark., Nov. 30.

Mr. G. Clinton Gardner, General Manager of the Ohio River R. R., has resigned.

Mr. W. E. Williams, Superintendent of the Williams Rolling Mill, at Muscatine, Ia., died in that city Nov. 22, at the age of 48.

Mr. John Linton, a railway contractor, who carried out extensive works in western Pennsylvania, died at Rochester, Pa., Dec. 5, at the age of 86.

Mr. Frederick E. Degenhardt, electrical engineer, and Western manager of the Standard Underground Cable Co., of Pittsburg, died at Chicago, Dec. 7, at the age of 38.

Major Alfred Sears, M. Am. Soc. C. E., will lecture on "The Physical Geography of Peru" at the Engineering School of the University of the City of New York, Dec. 14.

Mr. William E. Kelly, of New Brunswick, N. J., proprietor of the National Iron Works and President of the National Water Tube Boiler Co., died at his home Dec. 11.

Mr. J. W. King has resigned his position as Assistant Superintendent of the Philadelphia, Reading & New England R. R., to accept that of Superintendent of the Providence Division of the New York & New England R. R.

Mr. Henry P. Focht, Superintendent of the Pencoyd Iron Works of A. & P. Roberts & Co., at Pencoyd, Pa., died at Roxborough, Pa., Dec. 2, at the age of 64. He entered the works 40 years ago as a heater in the iron mill.

Mr. John Surran has been appointed superintendent of water-works of Newport, Ky., and will therefore resign his position as Superintendent of Public Works, at that place, in which he will be succeeded by Mr. Wm. Helm.

Mr. W. H. Russell, Consulting Engineer of the Boston & Albany R. R., died at his home in West Springfield, Mass., Dec. 8, at the age of 76. He was connected with the road for nearly 50 years and was its Chief Engineer for about 30 years.

Mr. A. J. Campbell, who was at one time Superintendent of the Bureau of Repairs and Supplies in the Department of Public Works, New York city, died Dec. 6, at the age of 66. In 1868 he was in partnership with W. H. Van Tassell in the architectural ironwork business.

Mr. A. N. Molesworth has been appointed Chief Engineer and Superintendent of the Tennessee Division of the Ohio River Charleston Ry. Mr. G. Nutting has been appointed Supervisor of Bridges and Buildings, and Mr. J. A. Maxwell Supervisor of Roadway. The offices are at Blacksburg, S. C.

Mr. E. M. Roberts, formerly Superintendent of Motive Power of the South Carolina & Georgia R. R., at Charleston, S. C., has accepted the position of Superintendent of the Washington Carbon Co., of Washington, Pa., which manufactures carbons for arc lights, motors and dynamos, etc.

Mr. Oden Bowie, ex-Governor of Maryland, who died at his home near Baltimore, Md., Dec. 4, was one of the original promoters of the Baltimore & Potomac R. R., and in 1867 succeeded in interesting the late Edgar Thomson, President of the Pennsylvania R. R., in the project. He was born in 1826 and served in the Mexican War.

Mr. Robert Quayle has been appointed Superintendent of Motive Power of the Chicago & Northwestern Ry., vice Mr. Wm. Smith, resigned. Mr. Quayle was Master Mechanic of the Milwaukee, Lake Shore & Western Ry. prior to its consolidation with the Chicago & Northwestern, and has been in charge of the Kaukauna shops since.

Mr. R. Mohn and M. J. H. Hoff have opened offices in the Association Building, Chicago, Ill., as consulting engineers and contractors, making a specialty of bridges and structural iron work, under the firm name of Mohn & Hoff. The former has been associated with Mr. A. Gottlieb and Mr. C. L. Strobel, and the latter with the Milwaukee Bridge & Iron Works.

Mr. Frank Wenter was for the fourth time elected President of the Board of Trustees of the Sanitary District of Chicago at the annual meeting held Dec. 4. Mr. Wenter was first elected to this office Dec. 8, 1891, at the time the second Board of Trustees was organized, under whose administration practically all of the work toward the construction of the Chicago Main Drainage Channel has been accomplished.

Mr. Samuel Robbins, one of the oldest manufacturers of charcoal iron in the United States, died at Lakeville, Conn., Dec. 6. He was born at Canaan, Conn., in 1804, and entered Union College in 1826. Soon after leaving college he went into the iron business in Connecticut, and continued the business until his death. For many years he furnished the government small-arms factories at Springfield, Mass., and Harper's Ferry, Va., with iron for rifle barrels.

Mr. John P. O'Donnell, M. Am. Soc. C. E., signal engineer, of London, Eng., has resigned his position with Dutton & Co., signal engineers, and gone into partnership with Mr. Evans, under the firm name of Evans, O'Donnell & Co., making a specialty of the design and erection of railway signal and interlocking plants, with offices at Palace Chambers, Westminster, London. The plant put in at the Waterloo terminal station by Mr. O'Donnell was described in our issue of June 23, 1892, and an abstract of his paper presented at the annual convention of the American Society of Civil Engineers was given in our issue of June 28, 1894. Mr. O'Donnell is Consulting Engineer of the National Switch & Signal Co., of Easton, Pa.

Gen. Eliakam Parker Scammon, who was engineer of New York harbor under Gen. Newton, died on Dec. 7 at Audubon Park. Gen. Scammon was born in Whitefield, Me., Dec. 27, 1816; entered West Point in 1833 and graduated in 1837 fifth in a class of 52. He was later professor of ethics and mathematics at West Point. He served in the Seminole War, was aide to Gen. Scott in the Mexican War, was Colonel of the 23d Infantry in the Civil War, and was captured in 1864 and confined in Libby Prison and at Charleston. He was engaged in astronomical work under Prof. Nicollet in 1840, and from 1847 to 1854 was connected with the survey of the Upper Lakes. He resigned from the Army in 1856 and was for a time professor of mathematics in St. Mary's College, Cincinnati, and later professor and director of the Polytechnic College, of that city. In 1870 he was U. S. Consul at Prince Edward's Island, and later was an engineer on the New York harbor work under Gen. Newton. In 1875 he was made professor of mathematics at Seton Hall College, South Orange, N. J.

Count Ferdinand de Lesseps, the originator and promoter of the Suez Canal, and whose later years were clouded by his connection with the Panama Canal, died on Dec. 7 at his home, the Chateau la Chesnaye, in Vatan, near Paris. Ferdinand de Lesseps was the son of Count Mathieu de Lesseps and was born at Versailles on Nov. 19, 1805, and at the age of 20 years was attached to the French consulate at Lisbon, and three years later to that at Tunis. In 1831 he went to Egypt, and at three different times he was temporary consul-general at Alexandria. In 1833 he was consul at Cairo; in 1839, at Malaga, and in 1842, at Barcelona, and for his services during the bombardment of that city by Espartero he was decorated by a number of foreign governments, and made Minister to Spain in 1848. He was later sent as Minister to Italy, but was recalled for advocating too liberal a system of government for the Roman people. During his stay in Egypt, M. de Lesseps brought about a reconciliation between Mehamet Ali, the Viceroy of Egypt, and the Sultan of Turkey, and in so doing he became very friendly with the Viceroy's fourth son, Mohammed Said, better known as Said Pasha. Having closely studied canals while consul at Rotterdam, in 1838, he conceived the idea of uniting the Mediterranean and the Red Sea; but it was not until 1854, after the death of the Khedive Abbas Pasha, that he saw an opportunity of putting his plans into execution. He then again went to Egypt on the invitation of his friend Said Pasha, then Khedive, and with that ruler and a large retinue he personally examined the route, and surveys were commenced. Almost every government of Europe opposed the scheme, and it was only by the personal interest in the enterprise taken by the Empress Eugenie of France that Napoleon III. was induced to lend his influence for promoting the enterprise. Other nations soon followed the lead of France, England and Holland alone excepted. The Viceroy granted de Lesseps, on Jan. 5, 1856, a charter for 99 years, and the Suez Canal Co. was organized with a capital of $20,000,000. Work was not commenced until 1859, and its prosecution was attended with many difficulties and much delay. De Lesseps triumphed over all adverse circumstances and on Nov. 17, 1869, the Suez Canal was formally opened in the presence of the Empress Eugenie, the Emperor of Austria, and representatives of other governments. This 100 miles of canal really cost about $93,000,000, and much of this enhanced cost was due to the opposition of England. De Lesseps, now one of the most honored men in Europe, and flushed with his success at Suez, was consulted by engineers on every great project and himself proposed among others the conversion of the Sahara into an inland sea, the cutting of the Corinth Canal and a Central Asian railway to connect Southern Europe with India. He is said to have had his attention drawn to the Panama Canal scheme by the efforts in that direction made by Mr. Frederick M. Kelley, of New York, who, as early as 1852, obtained a concession from the Colombian government for this purpose. But this concession had expired and the French enterprise of 1875 may be said to have been a new venture in that direction. De Lesseps in that year organized his Isthmian exploring expedition and prepared the way for the International Canal Congress of 1879, which selected the route upon which the canal was started. The construction company was organized in 1880 and Count de Lesseps, then in his 76th year, visited London, New York and Washington in personally promoting the enterprise, and he formally opened the work on the canal at Panama. He confidently announced that the canal would be finished in 1888. With a capital of $60,000,000, work was commenced on a reckless scale and without sufficient surveys, only to end, about six years later, in the most colossal failure and monument of corrupt management of the century. The general consensus of opinion is that Count de Lesseps had little other part in this scandal than giving countenance to men who grossly deceived him, and among those men was his own son. Count de Lesseps was married for the second time in 1870 to Mlle. Helene Autard de Bregard, a young lady of 24 years, who fell in love with him at a reception.

NEW PUBLICATIONS.

POOR'S DIRECTORY OF RAILWAY OFFICIALS AND MANUAL OF AMERICAN STREET RAILWAYS, 1894. New York: H. V. & H. W. Poor. 8vo; cloth; pp. 501; $3.

The edition of this directory which is just out contains (in addition to the usual complete list of railway officials, with special lists of master mechanics, purchasing agents, chief engineers, master car builders, master car painters, and general managers and general superintendents) the officials of belt, terminal, connecting, transfer, incline and gravity railways, ferry and union depot companies auxiliary to the railway systems; the officials of incorporated and unincorporated mining and logging railways, and of railways in course of construction or recently completed but not yet in operation. The statistics of street railway and traction systems in the United States and Canada are supplemented with tabulated statements showing the mileage, equipment, capital stock, bonds, earnings, expenses, etc., of such roads in Massachusetts, New York and Pennsylvania. The summary of railways projected and under construction, which has been published for some years, has been omitted from this year's edition.

MECHANICS—THE ELEMENTARY PRINCIPLES OF. Vol. I. Kinematics. By A. Jay Du Bois, C. E., Ph. D., Professor of Civil Engineering in the Sheffield Scientific School of Yale University. Author of "Elements of Graphical Statics," "The Strains in Framed Structures," etc. New York: John Wiley & Sons. 8vo; 231 pp.; many diagrams; $3.50.

As is proper in a treatise upon a branch of science dealing with the measurable relations of time and space only, the first two chapters are devoted to what may be called definitions of units of time and length based upon the latest and most exact usage. The general principles of the subject are then taken up and followed to the broader treatment in a plain sequence. As the work is intended primarily as a text-book for students, it is arranged, by the character of the type used, for both an abridged course and a course for advanced students. Articles containing applications of the calculus are also especially marked. The work is excellently adapted to its purpose.

ANNUAL OF THE AMERICAN SOCIETY OF IRRIGATION ENGINEERS FOR 1892-3. Denver: Published for the Society. Address John S. Titcomb, Secretary, Denver. 8vo; paper; pp. 209; illustrations.

This society was organized in September, 1891, at the time of the first irrigation congress, held in Salt Lake City, in that year. Its membership now includes a large part of the more prominent men who are follow-

ing the profession of engineering, more especially hydraulic engineering, in that part of the West where irrigation is practiced. The annual contains the report of the organization of the society and its transactions, constitution and list of members, besides a number of interesting papers on irrigation and closely allied subjects by members of the society.

NEW ENGLAND ROADMASTERS' ASSOCIATION. Proceedings of Twelfth Annual Meeting, held at the American House, Boston, Mass., Aug. 15, 16, 1894. Edited by the Secretary, M. C. Hamilton, N. Y., N. H. & H. R. R., Hartford, Conn. 8vo; pp. 112.

The principal subjects discussed at the meeting were "Labor on Track," "Snow Plows and Flangers," "Guard Rails," "Rail Joints" and "Tie-Plates." There is also the paper on "Rebuilding the Pennsylvania R. R. after the Johnstown Flood," which was read at the meeting by Mr. J. T. Richards, Engineer of Maintenance of Way of the Pennsylvania R. R. (Eng. News, Aug. 16, 1894).

TRADE PUBLICATIONS.

BRAKESHOES. Sargent & Co., Chicago, Ill. 12mo; pp. 11; illustrated.

This pamphlet is devoted to a description of the Sargent tire-dressing brakeshoe, which bears upon both flange and tread of wheel, thus preventing hollow tires and sharp flanges. The use of such brakeshoes has effected a great saving in enabling locomotives to be kept out of the shop for a longer time without turning down the tires. The Sargent Co. makes brakeshoes for use on all classes of wheels.

ALTITUDE AND DISCHARGE OF FIRE STREAMS. —Computed by Jno. W. Hill, Cincinnati, O. Addyston Pipe & Steel Co., Cincinnati. Pamph., pp. 8.

Four pages of this pamphlet are devoted to diagrams showing the altitude and discharge of fire streams, with varying pressures and with both smooth and ring nozzles of different sizes. The remainder of the pamphlet contains a revised list of standard specials with approximate weights, and the weights of cast iron gas and water mains.

ELECTRIC CAR HEATERS. Consolidated Car Heating Co., Albany, N. Y. 8vo; pp. 28; illustrated.

This company's electric heaters for street cars are now in operation on about 1,000 cars in 74 cities of the United States and Canada. This catalogue contains a description of the heater and tables of cost of operation, together with instructions for use. Electric heaters for office and house use are also shown.

SOCIETY PROCEEDINGS.

CANADIAN SOCIETY OF CIVIL ENGINEERS. The subject of the meeting at Montreal on Dec. 6 was "Transportation on our Inland Waterways and Canals," a paper being read by Mr. A. L. Hogg. Papers read at former meetings entitled "Building Railways Across Peat Bogs or Swamps" and "Notes on Retaining Walls in Montreal" were discussed.

ENGINEERS' CLUB OF ST. LOUIS.—The annual meeting was held on Dec. 5. The report of the Executive Committee showed that the total membership remained unchanged at 179, and that the expenditures had amounted to $1,290. The secretary's report recorded 11 papers and 10 addresses of a more or less formal character, and six papers have been approved for publication in the journal. The treasurer's report showed a balance of $142.

ASSOCIATION OF ENGINEERS OF VIRGINIA. The regular autumn meeting was held in Roanoke, Va., Nov. 17, with the President, Mr. C. S. Churchill, in the chair. A paper was read by Mr. M. E. Yeatman on "The Best Arrangement of Longitudinal Braces for Timber Trestles," showing how the braces should vary with the different heights of the structure. A paper entitled "Notes on Steel" was read by Mr. H. A. Gillis, describing the different processes of manufacture both now and in earlier days, and showing the different qualities due to variations in chemical composition.

TEXAS IRRIGATION CONVENTION.—The first state irrigation convention, it is said, ever held in Texas, was opened at San Antonio on Dec. 4 with some 200 delegates present, all the counties in southern Texas being represented. The first paper presented was by Prof. T. E. Dumble, State Geologist. It was entitled "Some Sources of Water Supply for West Texas," and was published in full in the Dallas "Morning News" for Dec. 6. Prof. Dumble described the various streams available for irrigation, and outlined what may be expected from artesian supplies. At the second day's session Maj. C. E. Dutton, U. S. A., reviewed the history of the irrigation laws in the Western states, and Mr. Chas. Corner opened a discussion on methods of irrigation.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—At the regular meeting on Dec. 3, the committee on Mr. Corthell's proposition for an international institute of engineers and architects (Eng. News, Nov. 1), reported adversely to the plan. Mr. J. N. Armstrong introduced the subject of "Riparian Ownership of Lands Bordering on Lakes and Rivers," and showed the incompleteness of the United States laws on the subject. He suggested that in the case of rivers riparian rights should extend to line midway between the meander lines instead of the ever-changing channel. Mr. C. A. Alderman stated that at Eau Claire, Wis., extensive encroachments have been made by private parties within the meander lines of the Chippewa and Eau Claire rivers, but that the municipality has not yet taken steps to correct this notwithstanding much agitation by individuals.

C. L. Annan, Secy.

ENGINEERS' CLUB OF PHILADELPHIA.—At the meeting on Dec. 1 a special committee reported upon the proposed International Institute of Engineers and Architects. The committee thought that while the objects of such an organization were commendable they could be accomplished by the national societies of each country, and the publication of domestic and foreign papers was already done to a large extent by existing societies. They did not, therefore, approve of the suggested organization. This report was adopted as the sense of the Club. A memorial upon the late Henry W. Dunne was read. The officers nominated for 1895 were George S. Webster, President; John L. Gill, Jr., Vice-President; L. F. Rondinella, Secretary, and George T. Gwilliam, Treasurer. Mr. F. H. Lewis read a paper upon "Specifications for Portland Cements and for Cement Mortars."

L. F. Rondinella, Secy.

MICHIGAN ENGINEERING SOCIETY.—The next annual convention will be held at the Hotel Downey, Lansing, Mich., Jan. 15, 16 and 17, 1895. The questions of increasing the annual dues and changing the articles of incorporation so as to bring the directors' annual meeting at an earlier date will be submitted. A partial list of the papers is as follows: "Rights to Land by Possession," by Judge F. A. Hooker, of the Supreme Court; "Difference in Magnetic Needles," Messrs. Gurley, Buff & Berger and L. Beckmann; "Masonry of the Lock in the 'Soo' Canal," J. L. Callard, U. S. Engineers; "Old Surveys of Detroit," Thomas Campau, Detroit; "Street Railway Construction," R. W. Roberts, City Engineer, Saginaw; "Water Waste," G. S. Williams, Superintendent of Water-Works, Detroit; "Tunneling for Sewers," Albro Gardner, Seattle, Wash.; "Some Details of Sewer Construction," F. F. Rogers, City Engineer, Port Huron; "Special Assessments," M. C. Taft, City Engineer, Kalamazoo; "Grand Rapids Plaster Quarries," C. H. Redman, Grand Rapids; "Grades for Highways," John Randall, Mio; "Transmission of Power," E. Dennis, Jackson; "Highway Bridges in Manufacturers' Hands," Prof. H. K. Vedder, Agricultural College; "Field Work of Surveys in Marquette Co.," Chas Cummings, Marquette; "Tests of Blasting Powders," H. Melchers, Saginaw; "Mineral Resources of Northern Arkansas," E. L. Hays. Papers are also expected from J. J. Granville, of Saginaw; William G. Fargo, of Jackson; Prof. C. E. Greene, of Ann Arbor, and others.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on Dec. 19 papers are to be presented by Mr. Guy B. Waite, on "Wind Bracing in High Buildings" and by Prof. Mansfield Merriman on "The Strength and Weathering Qualities of Roofing Slate." Prof. Merriman shows that the value of the slate quarried in the United States has doubled during the past ten years. Pennsylvania produces nearly one-half the total. The paper describes tests of slates from Vermont, New York, Harford county, Md., and York county, Pa., and tests conducted by the author to determine strength, toughness, density, softness, porosity and corrodibility.

The author sums up his results as follows: That tests for the density and softness, although of importance for slates of the same locality, are not good indications of the strength and weathering qualities of those of different regions; that tests for porosity, corrodibility and flexural strength give good indications of these properties; that the results found for strength and corrodibility when mentally combined give on the whole an excellent idea of the value of the slate, and that an impact test with a wooden ball shows both strength and toughness, while at the same time it indicates the capacity for resistance to corrosion. The impact test may therefore be recommended, if only a single test is to be used, as one which can be cheaply made and one likely to give reliable information of the comparative value of different kinds of slate.

NEW JERSEY STATE SANITARY ASSOCIATION. —The 20th annual meeting of the association was held at Trenton Dec. 7 and 8. The first paper on the program was by Mr. J. C. Smock, State Geologist, on the "Extent of the Diffusion of Material Poison from Large Areas of Wet Land in the State." Mr. Smock pointed out some misconceptions in relation to the cause of malaria. Though often found in low, swampy places, it is not wholly idigenous to them, some of the lowest and dampest sections of northern New Jersey being free from it. Mr. Smock believes that malaria can exist only where the subsurface drainage is very poor, and cited many instances of diminution of malaria after the introduction of such drainage. In New Jersey the terminal glacial morraine, which crosses the state just south of the latitude of New York city, is the dividing line between malarial and non-malarial districts. South of this line Mr. Smock says there is no malaria, the land being well drained by streams running into the ocean. North of the line there are sections which have poor drainage, owing to the retention of water by the glacial drift, and here malaria exists.

In the discussion which followed, Mr. Libbens Wood, M. Am. Soc. C. E., of Jersey City, stated that the low lands of the Passaic River were greater in extent than was generally realized, being 47 sq. miles in area, and that from so large a district malaria might be carried through the atmosphere to distances affecting all of northern New Jersey and also along the lower part of the Hudson River. This idea was opposed to a statement by Mr. Smock that malaria cannot be transmitted through the air a greater distance than two miles.

Dr. G. J. V. Schott, of Passaic, stated that in Holland the ground water stands very near the surface, and that in this case the absence of malaria was probably due to the continuous change of water in the ground by pumping.

In conclusion, Mr. James Owen, M. Am. Soc. C. E., Montclair, stated that elevation above sea level was a most important factor, and that malaria was confined to a zone, limited by a 700-ft. contour, above which no malaria exists.

A paper on the "Ventilation of the Separate System of Sewers," by Mr. Parker N. Black, of Asbury Park, is abstracted in another column, and is noticed editorially in this issue. Mr. V. L. Davey, of East Orange read a sensible paper on the ventilation of school buildings, and Maj. Z. K. Pangborn, editor of the "Evening Journal," of Jersey City, read a paper on "The Relation of Modern Journalism to Sanitation." Prof. I. M. Watson, of Elizabeth, was elected corresponding secretary for the coming year.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The first part of the proceedings of the society at its New York meeting last week was given in our last issue. On Tuesday evening Messrs. Samuel and S. S. Webber presented a paper on "Trials of a Vertical Triple Condensing Pumping Engine at the Trenton Water-Works." This paper, with two others by Mr. F. W. Dean, is abstracted elsewhere in this issue. Among the "Papers on Steam Engineering," printed elsewhere in this issue, is included another paper by Mr. Dean on a test of a Rockwood engine and a paper by Profs. Cecil H. Peabody and Edw. F. Miller on "Tests of the Triple Expansion Engine at the Mass. Institute of Technology."

Another paper at this session also described work done in the laboratories of the same school. It was entitled "Tests of the Strength of Spruce Columns," by Profs. Gaetano Lanza and Edward F. Miller. This paper gave the results of 13 tests of spruce columns, made on an Emery testing machine. The length of the columns ranged from 5 ft. 9¾ ins. to 17 ft. Most of them were about 8 ins. square, but two were 10 × 10 ins., and two were about 8 × 12 ins. The ultimate compressive strength ranged from 1,909 lbs. per sq. in. for a column 8 ins. wide and 12.13 ins. deep and 9 ft. 10¾ ins. long, to 3,195 lbs. for a column 7¾ × 7¾ ins., 7 ft., 8.38 ins. long. The first column, named above, showed a modulus of elasticity of 1,009,200 lbs., and the second, 1,222,400 lbs., the first deflecting horizontally 1¼ ft. from the respective ends and the second crushing 1½ ft. from the platform.

On Wednesday morning the first paper read was "On the Theory of the Moment of Inertia," by Mr. C. V. Kerr. The author gave several definitions of the term, and proceeded to a mathematical investigation of the subject from which a theory of the moment of inertia was evolved, designed "to invest that 'barren ideality' with a distinct and physical meaning, so that it may be kept where it belongs." Prof. De Volson Wood sent in a written discussion on this paper in which he stated that the term moment of inertia is in technical literature and likely to remain, and that one thing may be equal to another numerically, but not be the same thing.

Four papers relating to various features of a new steam engine invented by the author were then read by Mr. Chas. T. Porter. These papers are considered together in another part of this issue.

Prof. C. B. Richards sent a written discussion of Mr. Porter's paper, in which he stated that most of

the features of the engine commended themselves to him at once, but others needed more study. In working up the records of over 1,000 Baxter engines, he had found that a jacketing similar to Mr. Porter's had worked well.

Prof. R. H. Thurston also sent a written discussion. The cam movement always seemed to him correct, but has its difficulties. We may expect to see the fixed cut-off do good work. The method of reducing clearance is a distinct advance. The jacket and separator were also commended by Prof. Thurston.

Mr. Rockwood commended the design of the frame of Mr. Porter's engine, and advocated cutting out the intermediate cylinder, in accordance with his own system.

In response to an inquiry whether special provision had been made to prevent wear of the piston valve, Mr Porter said that wear of such valves was caused by imperfect surfaces, bad bearings and distortions. By preventing the causes of wear no wear would result.

Mr. F. W. Dean stated that cam valve gears for reversing engines came to his attention some years ago, and Mr. M. N. Forney referred to a heart-shaped cam used quite extensively on engines built some time ago. The cam was made of cast iron, with a chilled surface.

The next two papers were by Prof. Gaetano Lanza, the first one being on the "Stresses in the Rims and Rim Joints of Pulleys and Fly Wheels." This is abstracted elsewhere, with other papers on steam engineering. In the discussion of this paper Mr. Wm. Kent said he wished it might be studied experimentally to determine the deflection of rims and arms under different loads. He suggeseted testing mechanically by placing double radial arms in the wheel with pins on the inner side to make scratches which could be measured.

The second paper by Prof. Lanza was on "The Application of Brakes to the Truck Wheels of a Locomotive." This paper is abstracted, together with others on railway engineering, in another column.

The last paper on Wednesday morning was by Mr W. F. M. Goss, on "An Experimental Study of the Effect of Counterbalance in Locomotive Drive-Wheels Upon the Pressure of Contact between Wheel and Rail." This paper, and one by Mr. David L. Barnes, presented on Friday, on "Rail Pressures of Locomotive Driving-Wheels," will be abstracted, together with the discussion, in a later issue.

The first paper Thursday morning was by Mr. C. J. Field, on "Present and Prospective Development of Electric Tramways." Roadbed, track-bonding, and electrolysis, line construction, underground conduits, cars and motors, power and car houses, cost of equipment and operation, were discussed. The storage battery was not considered by Mr. Field, as he did not believe it to be in such a state "that it needs to be considered commercially yet." Alternating currents, with the improvements now being made, are likely to be adopted in the future, especially for long-distance work.

Mr. Gus. C. Henning described a new underground conduit for an electric railway in Hamburg, now being built by Siemens & Halske. This system was described in the "Electrishcher Anzeiger" for Nov. 4. The conduit is built in inverted trough-like sections, the wire being placed near the top of the conduit above the water level, the water being kept down by the enclosed air. A low voltage will be used.

Mr. Oberlin Smith said that the mechanical features of this system seemed first-rate, but the pith of the whole matter would be leakage caused by moisture creeping up the side of the conduit. He suggested that the trough might be lined with a non-conductor.

A member said that Mr. Field had confined his paper to the railway of the present. The speaker believed the alternating current is going to play an important part in the near future. Referring to a proposed line of railway between Philadelphia and Harrisburg, and lines between other points, he said that it was proposed to locate primary stations at some water power or in a region of cheap coal and transmit power by the two-phase system to sub-stations, supplying current to local enterprises as well as to the company's railway.

Mr. Partridge took up the subject of wheels for electric cars. He said that some wheels are loaded as high as 9,000 lbs. each; the wheels of the heaviest Pullman cars carry only 7,500 lbs., and are not used as driving wheels either. Wheels for electric cars are being made of cast iron with chilled treads; with the dirt on the track this is like using an emery wheel for a driving wheel.

Some one called attention to the successful use of wheels of manganese steel in the coal regions. Another member spoke in favor of underground conduits in cities and described a new system now being tried in a Massachusetts town. Another speaker favored the use of the series system of distribution, and Mr. Oberlin Smith agreed that this would be desirable if a good one could be invented.

The next paper was on "Rustless Coatings for Iron and Steel," by Mr. M. P. Wood, and was supplementary to a paper by Mr. Wood on the same subject presented to the society at its Montreal meeting and abstracted in our issue of July 19, 1894. An abstract of this paper will appear in a later issue.

During the discussion many references were made to the rapid corrosion of cast iron exposed to salt water. Mr. W. F. Durfee said soft iron was more easily affected than hard and that to withstand corrosion a hard, close-grained iron should be used.

The speaker said that there is no place where corrosion is more rapid than in the anthracite coal regions. Here there have been many instances of good protection with equal parts of asphaltum and coal tar, applied hot. Sometimes pipes are lined with wood. For some special work a coating of silica and carbonate of soda in the form of paste was applied.

Mr. Geo. W. Bissell's paper on "The Effect of Clearance on the Economy of a Small Engine" is referred to with other papers on steam engineering elsewhere in this issue, as is Prof. D. S. Jacobus' paper entitled "Results of Experiments to Test the Accuracy of Small Throttling Calorimeters."

Mr. Bissell's paper was adversely criticised by Messrs. Hemenway and Sweet, and Mr. Kent called attention to the improper inclusion in the paper of many pages of the logs of the tests.

In discussing the paper on calorimeters by Prof. Jacobus it was brought out that the discrepancies in measurement were due to the failure of the instrument to obtain average samples of steam. Prof. Carpenter sent a written discussion, in which he said the conclusions were generally in accord with his experiments detailed in Vol. XII. of the Society's Transactions, but the experiments covered a wider range in the quality of steam than occurs in practice.

Thursday afternoon an extra meeting was held for the especial benefit of those who wished to express their opinions on iron foundry work and tests. At Tuesday's morning session, as noted last week, Mr. W. J. Keep reported for the "Committee on Uniform Methods of Testing Materials," and an animated discussion followed which was cut off before every one got satisfaction. Thursday afternoon the discussion continued for two hours or more with unabated zeal.

Mr. Wm. Kent and Mr. John T. Hawkins criticised Mr. Keep's diagram for shrinkage and Mr. Henning defended it.

Mr. Thos. D. West objected to ½-in. square test bars, and advocated round bars cast on end, in order to secure a more uniform density of material and more uniform cooling. Mr. Durfee also favored round bars.

The session Friday morning opened with a paper by Mr. John H. Barr, entitled "Experiments on a System of Governing by Compression." Like several others on steam engineering, this is abstracted in an article which is given in another column.

Prof. Thurston sent a brief discussion favorable to the paper, but said it was only a beginning.

Papers by Mr. Jos. C. Platt on "Straightening a Leaning Chimney 100 ft. High" and by Mr. A. W. Robinson on "Drawing Office Appliances" are presented in full elsewhere in this issue. In connection with the latter paper, two members spoke of the method of tracing directly upon ordinary paper by placing the original drawings below and the fresh paper above a sheet of glass, and putting a powerful light below the whole.

In the article in this issue embodying abstracts of the papers on railway engineering presented at the meeting will be found references to a paper by Mr. L. S. Randolph on the "Strength of Car Axles," and one by Mr. Geo. R. Henderson on "A Graphical Method of Designing Springs."

In discussing the paper on car axles Mr. Henderson said that recent experiments which they had been making showed little likelihood of springs being forced solid.

Mr. Henning described how axles are cracked gradually by separate impacts on crossing frogs, fracture after fracture resulting without a break in arcs of concentric rings on the upper side, until finally the axle gives way. He said he had in his possession a broken axle which shows over 60 distinct rings. Mr. Estrada thought that the fractures extended clear around the axle. Mr. Henning said that depended upon the position of the fractures.

The discussion on Mr. Henderson's paper on designing springs was opened by a communication from Mr. L. S. Randolph, who referred to the ease with which slight variations might be studied by this method. Mr. Wm. Kent referred to the papers on the subject and to tables used in Pennsylvania railway specifications

The next paper, by Mr. Barnes, has been referred to above. The meeting closed with two topical discussions. The first described a telephone system for factory use. No main switchboard or operator is required, the person using the instrument simply placing a plug into the hole corresponding with the number of the person whom he wishes to reach or moving a hand to a given number on a dial. The wiring may be installed so that the general manager can hear all that passes over the wires, while only the person with whom he is conversing can hear him.

The final remarks were made by Mr. M. P. Wood, who described a new gas-making process. In this process calcium carbide is used, and no heat is evolved. The calcium carbide is made from any good carbon, pulverized and mixed with ordinary builders' lime in the ratio of 2½ to 2. The mixture is fused in an electric furnace at some 4,000° F., 2½ tons of carbon and 2 tons of lime making two tons of the carbide. Upon the value of the by-products will depend the cheapness at which the gas can be furnished.

The calcium carbide is put up in air-tight packages, to prevent slaking. To generate gas the only apparatus necessary is a metallic vessel in which the carbide and water may be placed. The C_2 of the calcium carbide, $Ca\ C_2$, unites with the H_2 of the water to make $C_2\ H_2$, which is pure acetyline gas. One ton of this calcium carbide, Mr. Wood stated, will make an amount of gas equivalent to from 80,000 to 100,000 cu. ft. of ordinary city gas of 24 to 26 c. p.

It is expected that this process will be available commercially in a month or so. It was discovered accidentally by Mr. Louis C. Wilson, of Leesburg, N. C. Further particulars may be obtained from Mr. Wilson, at 45 Broadway, this city.

Mr. Wood stated that a space 4 ft. square in the corner of a cellar would be sufficient to generate gas enough for a half dozen houses, and that this process will have many advantages over gas machines for isolated lighting, one of which is its extreme simplicity. Whether the gas can be used for city lighting will depend upon the cost of producing it on a large scale.

A number of excursions to points of interest were provided during the convention, and on Wednesday evening there was a large gathering of the members and their friends at Sherry's, where the retiring President, Mr. Eckley B. Coxe, delivered an address. The convention was the largest in the Society's history, over 425 names being registered at headquarters.

As already announced, the next general meeting of the Society will be held in Detroit, in June, 1895, but it was voted by the members that monthly meetings for the discussion of matters of mechanical interest be held during the winter months, and a committee was appointed to arrange for such meetings.

COMING TECHNICAL MEETINGS.

FRANKLIN INSTITUTE, PHILADELPHIA.
Dec. 14. "Watch Manufacture," by E. A. Marsh. Secy., W. H. Wahl.

ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 15. Secy., L. F. Rondinella, 1122 Girard St.

ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 17. Secy., E. Nexsen, Kasota Block.

WESTERN RAILWAY CLUB.
Dec. 18. Secy., W. D. Crosman, Rookery Building.

COLUMBIAN ENGINEERING SOCIETY.
Dec. 18. Secy., W. F. Hart, Washington, D. C.

ENGINEERS' CLUB OF ST. LOUIS.
Dec. 19. Secy., W. H. Bryan, Turner Block.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 19. Secy., Francis Collingwood, 127 E. 23d St., N. Y.

ASSOCIATION OF ENGINEERS OF VIRGINIA.
Dec. 19. Secy., J. H. Pilcher, Roanoke, Va.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 19. Secy., S. E. Tinkham, 36 Bromfield St.

NEW YORK RAILROAD CLUB.
Dec. 20. Secy., John A. Hill, Temple Court, N. Y. City.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Dec. 20. Secy., D. Carhart, Carnegie Library Building, Allegheny.

ENGINEERS' CLUB OF CINCINNATI.
Dec. 20. Secy., J. F. Wilson, 24 W. 4th St.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Dec. 26. Atlanta, Ga., Secy., F. A. Charplot, Macon, Ga.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 20. Secy., C. H. McLeod, 112 Mansfield St., Montreal.

ENGINEERS' CLUB OF INDIANAPOLIS.
Dec. 22. Secy., C. C. Brown.

WESTERN SOCIETY OF ENGINEERS.
Jan. 2. Secy., Thomas Appleton, Lakeside Bldg., Chicago.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 4. Secy., O. Van Geldern, 719 Market St., San Francisco.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 7. Secy., C. L. Annan, City Engineer's Office.

CIVIL ENGINEERS CLUB OF CLEVELAND.
Jan. 8. Secy., F. C. Osborn, 721 Hickox Building.

NORTHWESTERN SOCIETY OF ENGINEERS.
Jan. 8. Secy., D. W. McNorris, Burke Building, Seattle, Wash.

NORTHWESTERN RAILWAY CLUB.
Jan. 8. Secy., W. D. Crosman, Ryan Hotel, S. Paul.

DENVER SOCIETY OF CIVIL ENGINEERS.
Jan. 8. Secy., F. Ed. King, 36 Jacobson Block.

NEW ENGLAND RAILROAD CLUB.
Jan. 9. Secy., F. M. Curtis, P. O. Box, 1570, Boston, Mass.

ENGINEERS & ARCHITECTS' CLUB OF LOUISVILLE.
Jan. 10. Secy., G. W. Shaw, Norton Building.

ENGINEERING ASSOCIATION OF THE SOUTH.
Jan. 10. Secy., Hunter McDonald, Nashville, Tenn.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Jan. 11. Secy., D. W. Meeker, St. Paul, Minn.

MONTANA SOCIETY OF CIVIL ENGINEERS.
Jan. 12. Secy., G. O. Foss, Helena, Mont.

WISCONSIN POLYTECHNIC SOCIETY
Jan. 14. Secy., Geo. G. Mason, 144 8th St., Milwaukee.

ENGINEERS' CLUB OF KANSAS CITY.
Jan. 14. Secy., F. W. Tuttle, Baird Building.

CENTRAL RAILWAY CLUB.
Jan. 13. Secy., S. W. Spear, East Buffalo Iron Works, Buffalo, N. Y.

MICHIGAN ENGINEERING SOCIETY.
Jan. 15, 16, 17. Annual convention at Lansing, Mich. Secy., F. Hodgman, Climax, Mich.

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Service connections larger than 3 ins. in diameter for automatic fire sprinklers and elevators have been prohibited by the water commissioners of Atlanta, Ga. While it is evident that the supply of water from city mains for some private purposes must be limited by the amount of water available and the capacity of the street mains, it seems highly desirable that to automatic sprinkler systems, which are used only in cases of emergency, an effort should be made to supply as much water as may be needed by a given building. Possibly a 3-in. service is ample for any building in Atlanta, but, if so, not many larger connections would be likely to be made anyway, on account of extra expense. Just how much water a city should furnish for elevators and other power purposes is a matter for each community to decide, but it is pretty well settled that the best possible fire protection should be furnished in any event. The use of automatic sprinkler systems should be encouraged by every water department, for the drain on the system which they cause is as nothing compared with the water which would be used if the fires which automatic sprinklers extinguish at the start were allowed to gain headway.

There has been much complaint among makers and sellers of iron and steel during the past 18 months, that purchases by the railways have been reduced to very small amounts. The iron and steel men have consoled themselves by ascribing this state of affairs to the poverty of the railway companies. It has been said that they were economizing by delaying necessary repairs and the purchase and building of new equipment as long as possible, and that eventually they would have to enter the market as heavy purchasers to make up for past deficiencies. Undoubtedly there is much truth in this view of the case; but if the methods put into use on the Chicago Milwaukee & St. Paul Ry. are a fair sample of the economies which the general order for retrenchment issued on practically all railways has brought about, then it is reasonable to conclude that railways in the future are likely to purchase less iron and steel than in the past. In a paper printed in our last issue, Mr. J. M. Barr, Superintendent of Motive Power of this road, told how he brought down the total purchases of round iron by his company during the past 10½ months to a trifle of 154 tons. The paper pointed out a fact which has been too little realized in railway service in the past, that there is a distinction between worn-out material and material which only needs small repairs to be good for further service.

In our issue of Nov. 22 we described the process by which Mr. E. W. McKenna, late Assistant General Superintendent of the Chicago, Milwaukee & St. Paul, proposes to reroll old rails to make them practically as good as new. Apparently if the methods devised by the officers of this progressive railway company come into general use, the rolling mills will no longer find the railway trade their mainstay.

One of the compensating advantages of a period of financial depression or "hard times" is that it may (but unfortunately not always does) lead to an investigation being made by heads of departments to see where expenses may legitimately and profitably be reduced. Such investigations, of course, are made by many men at times other than those of financial depression, but they have become more general during the period of the depression which now seems to show signs of lifting. In railway service, for example, several companies have been investigating the loading of freight trains, with most surprising results, as recorded by Mr. W. W. Wheatley in his paper on the rating of train loads (Eng. News, Oct. 4, 1894). Some of the cars were found to be carrying a few pounds only, and a great number were not loaded to anything like their full capacity, so that when freight engines were given train loads regulated only by the number of cars, the cost of hauling was very often excessive, as a train of the regular number of cars might carry but a comparatively small amount of paying load. In such a case a large proportion of the expense of transportation would be for hauling dead load of cars, and by looking more carefully after the actual weight of the trains considerable reductions in expenses could be effected. The work done by Mr. Barr on the Chicago, Milwaukee & St. Paul R. R. in utilizing the good material in the scrap heap, which we have referred to above, is another excellent example of what can be done in helping the right side of the balance sheet when a falling-off in business gives time to look after the small leaks in the expense account. These are only specific instances, but they open up suggestions for a wide field of investigation in the matter of economies and economics.

The bill legalizing pooling by railway companies passed the House of Representatives on Dec. 11, and will probably pass the Senate with little opposition. The bill provides that every pooling contract must be filed with the Interstate Commerce Commission, and does not become operative until 20 days after such filing, during which the Commission may disapprove such contract. It is further made the duty of the Commission to watch the workings of every such contract, and if it finds in any case that the contract is working injury to the public in any particular, it may require the contract to be modified or may disapprove and annul it. The acts of the Commission are made enforceable by and are subject to review by the United States Circuit Courts. We believe this is the first instance ever recorded of the legalizing of contracts in restraint of competition by legislative action. Under the common law, when strictly applied, all such contracts have been always held to be in restraint of trade and hence against public policy and non-enforceable. There is little doubt, however, among those who are best qualified to give an opinion and have given the matter careful study, that the legalizing of pooling contracts is not only needed for the rescue of railways from bankruptcy, but is actually a measure in the interest of the public.

The ventilation of sewers is a question which has been discussed to a great extent in the past, and on which a great deal of worse than useless matter has been written. Elsewhere in this issue we publish an abstract of a paper on the "Ventilation of the Separate System of Sewers," read by Mr. Parker N. Black, before the New Jersey State Sanitary Association. Mr. Black believes that properly designed sewers, with good grades, with automatic flush tanks where necessary, and with plenty of openings directly from the sewers to the street, in the shape of perforated manholes, will give no trouble. He is averse to ventilating sewers through house connections and soil pipes, as is sometimes done, by omitting the main trap on soil pipes, and says no extra ventilating pipes are necessary, which indirectly condemns running a ventilating pipe from a point outside the main trap in the soil pipe up above the roof level.

There is much to be said in favor of Mr. Black's conclusions, providing ample ventilation can be secured through manhole perforations, and that these will not become stopped up by dirt, or by ice and snow.

If everybody believed that main traps can be safely omitted from soil pipes, thus making each house connection with its vertical soil pipe extending above the roof or ventilator to the sewerage system, the problem might be solved in this way, and the solution would be extremely simple and inexpensive. Where the main trap is insisted on, as we believe it still is almost everywhere, separate ventilation pipes may be provided, running from just outside the main trap to a point above the roof. This adds materially to the cost of the plumbing of an ordinary house, and where the pipe must be carried up outside the building, it is often objected to on aesthetic grounds. But if sewers must be ventilated through the house system, it seems probable that most people, whether householders or engineers, would prefer this method to carrying sewer air through the plumbing system proper, past fixture-traps, which may at times lose their seal. Either method provides for the thorough ventilation of the house sewer, or connection between the house and the street sewer.

The danger from the admission of sewer air to houses is chiefly that common to the admission of any other bad air to buildings. Most of the talk of the past regarding the disease germs carried by "sewer gas," as the air in sewers has been called, perhaps very unappropriately, has been ill advised, as there is little chance of disease germs being conveyed by air from sewers. But no one wishes to breathe this air, any more than to breathe or eat or drink any other foul thing.

The aim, therefore, must be first to try to build sewers so that all sewage will be removed before decomposition sets in, making stoppages rare in occurrence and easy of removal, and next to provide an ample circulation of air through the sewers. If this can be effected by means of manholes or other openings to the street, there will be no necessity for ventilating through the house system, so far as the street sewers are concerned. There will remain, however, the connection between the sewer and the house, in which there can be no change of air unless there is a clear opening to the roof through the soil pipe, or, when a main trap in the soil pipe is used, a fresh-air inlet just outside this trap. As the air will pass both in and out of this vent it may be considered desirable to extend it to the top of the roof. Were it not for this house sewer, or if it can be provided for otherwise, the number of ventilating pipes necessary for small sewers might be much less than the number of sewer connections. When this was the case, perhaps, the cost of such pipes would be chargeable against the cost of the sewerage system, instead of to house owners.

We publish, on another page, an abstract of the Interstate Commerce figures for railway earnings in the year ending June 30, 1894. The reports, covering 150,000 miles of line, in round numbers, show a falling off in net earnings available for the payment of interest and dividends of $44,555,863. The natural tendency is to lay this decrease at once to the falling off in business, consequent upon the financial depression; and the report does show a heavy falling off in freight traffic during the year. The passenger traffic, however, shows an actual increase, by reason of the heavy World's Fair travel. But a fact which railway officers will do well to ponder is that over half of the falling off in net earnings was not due at all to the loss of traffic, but to carrying the traffic at lower rates. In the year in question the average freight rate per ton mile declined 0.012 ct. (from 0.878 ct. to 0.866 ct.) This decline in freight rates reduced the railway revenues $8,451,150. The passenger rates also fell from 2.108 cts. in 1893 to 1.976 cts. in 1894, and this

reduction, small as it is, made a difference to the railway revenues of $17,014,716. Of course the special World's Fair rates are partly responsible for the falling off in passenger rates, and probably considerable traffic was gained by the low rates. At the same time the fact remains that lower rates and not diminished business are responsible for more than half the falling off in railway profits, payable to stock and bond holders. If railway owners want returns from their investments they had better investigate their traffic departments.

THE PHYSICAL QUALITIES OF BRICKS.

We present in another column a very elaborate table of the comparative physical qualities of paving and building bricks from almost all the important centers of manufacture in the United States; paving bricks from 12 different cities having been tested, and building bricks from 17 different cities, including in many cases a number of different makes from the same cities, or different qualities of bricks of the same make. These tests, moreover, were all made by the same person and the same methods and apparatus, so that relatively they should be very nearly correct, and the methods of test, as explained in another column, seem to be suitable and accurate.

We risk little in surmising that so much accurate information about the physical qualities of American brick has never before been gathered together in one table, and as a record the table has great value. It is not wildly exciting reading, and we regret to say further that it affords no basis for a code of rules for laboratory tests by which good and bad bricks can be infallibly separated. On the contrary, the general drift of the table is to indicate decisively that this cannot be done, and that there is not much use in attempting it. The table does, however, shed a good deal of light on a few points about bricks, and such light as is to be had we have endeavored to abstract from the confusing mass of figures, giving the table itself in extenso, simply as a matter of record. Complete tables of this kind have a special value which is largely destroyed by attempting to abbreviate them.

The most valuable part of the table, perhaps, and certainly the most decisive part, is that relating to paving bricks. Four classes of physical tests are given. (1) Abrasion test by tumbling, (2) absorption of water, (3) transverse strength, (4) crushing strength. For a private brick, resistance to abrasion is beyond doubt the most important quality, provided it is obtained without undue sacrifice of other qualities, and imperviousness to water the next most important quality for sanitary reasons, and to prevent disintegration by frost.

The tests of paving bricks amply prove that both of these desirable qualities can be had without undue sacrifice of strength, since they are shown to have little or no relation to either transverse or crushing strength. The accompanying table (headed "Tests of Paving Bricks") shows these tests arranged in order of resistance to abrasion, and from this table the following conclusions seem to be fully justified:

1. Paving brick are best tested by their resistance to abrasion when tumbled, and vary considerably in that respect, some losing nearly three times as much weight as others for a given amount of tumbling.

2. Any brick which will stand tumbling well has ample crushing strength, rarely chipping under less than 5,000 lbs. per sq. in., or crushing under less than 10,000 lbs. The crushing strength tends to vary with the resistance to abrasion, however, but more slowly and irregularly.

3. The transverse strength also tends to vary with the resistance to abrasion, but more slowly and irregularly. Good paving brick should show a modulus of 2,000 to 2,500 under transverse load, but brick with small resistance to abrasion, will often show high transverse strength, so that the test has only negative value.

4. The quantity of water absorbed in 24 hours should be small as an end in itself, but is a very rude test of the quality of the bricks in other respects. The toughest bricks tend to show the least absorption, and any paving brick absorbing much more than 1% of moisture in 24 hours is justly open to suspicion; but some of the best bricks will absorb more than 1% of water, and some of the poorest will absorb much less. All good paving bricks absorb less than 2%, which is greatly less than the best building brick absorb, as shown below,

There seems little room for doubt that these four rules for paving brick are trustworthy, so far as they go, and broadly applicable. As for building brick, it is much less easy to frame any positive rules. In the table below (headed "Tests of Building Brick") we give an abstract of about two-thirds of the building brick tests in the three items: Water absorbed in 24 hours, transverse stength and (ultimate) crushing strength. In that table the first three rules below are clearly indicated, and from the original table on another page the remaining rules may be deduced.

1. The strength of building brick, both transverse and crushing, varies in tolerably close inverse ratio with the quantity of water absorbed in 24 hours. The strongest bricks absorb least water.

2. Good building brick absorb from 6% to 12% of water in 24 hours, and with no greater absorption than 12% will ordinarily show from 7,000 to 10,000 or more lbs. per sq. in. of ultimate crushing strength, and a transverse modulus of 700 to 1,200 lbs. or more.

3. Poor building brick will absorb from 1-7 to ¼ of their weight of water in 24 hours, and average a little more than half the transverse and crushing strength of good brick.

4. An immersed brick is nearly saturated in the first hour of immersion; in the remaining 24 hours the absorption is only 0.5 to 0.8% of its weight, as a rule.

5. The strength of bricks in the kiln is least in the top courses and increases quite rapidly for the first 10 or 12 courses and afterwards more slowly down to the arch bricks.

6. The size of bricks varies greatly in different parts of the country, the weight varying from 3.84 to 6.34 lbs. The Eastern bricks tend to smaller sizes than in the West, but the variation is often considerable in different makes of bricks in the same locality.

7. Bricks made by the dry press are, as a rule, notably less porous and stronger than those made by the wet mud process. To this rule, however, there are some exceptions.

It would be easy enough to deduce some further indications from the table, but they do not seem to be sufficiently well indicated to make it justifiable to do so. The most extraordinary fact is the utter lawlessness in respect to size of bricks, a quality which in other countries is strictly regulated by law, but here seems to be left to the fancy of the individual manufacturer. Between the extremes of the table there is a difference in size as great as from 5 to 3 (165 to 100 exactly), so that price per M. alone is necessarily a very rude indication of value received, and no good reason can be assigned for this, except a varying boldness in yielding to a general desire of makers to make all bricks as small as possible. In England the ordinary size of brick is $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ ins., or 101¼ cu. ins., against only 91.88 cu. ins. for the smallest brick, which latter is the most used American brick, moreover, being the Hudson River brick, as represented by the output of Fishkill, N. Y.

There can be no doubt whatever how this contrast in size comes about. It originates in an unchecked desire to "skin" and defraud, and nothing else, and has come about gradually by a kind of evil process of evolution or "survival of the fittest," the smallest brick of each year, which would sell as a "brick," returning its maker most money, and hence tending to be produced in larger quantities next year, and to serve as a reduced standard from which still further skinning could go on. It follows of necessity from the general theory of evolution that this process will have gone furthest where the manufacture of brick has been carried on the longest and on the largest scale, i. e., with the sharpest competition, and the most cursory study of the table will show that this is in fact the case.

There are few stronger examples of the evil results of the devil-may-care American fashion of leaving such things to regulate themselves by "private enterprise" than this. The profit to the maker from paring down the size of bricks is very small; the loss to the consumer is very large. The wall built from such bricks not only takes many more bricks to lay, but more mortar and labor, and is a weaker wall when done, because of the larger proportion of mortar. There is probably not a maker but would be quite as well satisfied and make quite as much money to have the size of bricks rigidly regulated by law, provided only the regulation were in fact rigid, and equitable. But where there is no regulation—the competition between brickyards is sharp; the margin of profit small. If one yard lights upon some little trick of mixing, perhaps, by which the clay which makes 100,000 bricks will suffice to make 101,000 or 102,000, by filling the same molds a little less solidly, the addition to profit is sensible, the loss of size and weight almost insensible, so that the brick is as saleable as before. Seeing this, and seeing that his own bricks after burning are a shade larger than the market size, some rival maker betters his instruction by shaving down his molds a little, and thus establishes a new standard, from which still further reduction occurs in the course of years. This has been the actual course of events on the Hudson River, for the bricks made there fifty years ago were materially larger than they are to-day, as any one may see by consulting old notes and tables. We have not a sufficient volume of these to speak with positiveness as to what the standard size was, but the standard bricks on the Erie Canal work, as actually delivered, were some 50% larger than the standard Rochester and Fishkill brick is now, according to Mr. Fickes' table; and we apprehend that this was fairly indicative of what the Hudson River brick then was.

The evil effect of having no legal and rigidly enforced standard is precisely analogous to that of having no legally enforced standard pound or yard-stick. Experience has abundantly proven that under such circumstances competition drives men to cheat whether they will or no; they must do as their neighbors do, or go out of business. The old Hanseatic fish merchants, in Norway, regularly used two sets of weights, one to buy by and the other to sell by, and centuries of usage so established this custom, that finally it became a recognized and admitted feature of the trade, which only died out in comparatively recent years, with the establishment of effective inspection of weights and measures. The brick business calls loudly for similar inspection, not so much to force men to be honest, as to enable them to be so without being ruined. The small-sized brick is now such an established trade custom about New York and other Eastern cities, that the first effect of such regulation, if what it ought to be, would be somewhat confusing. Nevertheless, the first necessity for putting the brick businesss on a proper basis is to enforce by law considerably larger dimensions than are now on the market.

Tests of Building Brick.

Rearranged in order of ultimate crushing strength per square inch and sub-divided into (A) crushing strength 8,000 and over; (B) crushing strength, 6,000 to 8,000; (C) crushing strength, 5,000 to 6,000; (D) crushing strength, under 5,000.

(A) Crushing Strength over 8,000.

No. tested.	P. c. water 24 hrs.	Transverse mod.	Crsh. strength per sq. in.
2....	4.2	1,378	9,710
2....	3.6	1,308	9,580[1]
1....	5.8	1,745	9,490[1]
1....	11.5	893	9,490[1]
1....	10.8	851	9,260[1]
1....	7.4	1,359	9,150[1]
2....	5.8	934	9,380[1]
2....	5.0	1,096	9,380[1]
8....	5.9	1,285	9,030[2]
2....	4.7	1,224	9,010[2]
2....	9.4	947	8,980[2]
2....	6.7	971	8,980[2]
1....	11.6	1,015	8,930[2]
2....	8.3	895	8,890[2]
4....	9.8	1,086	8,860[2]
2....	6.8	674	8,820[2]
1....	11.0	1,106	8,770[2]
2....	6.5	1,528	8,640[2]
1....	12.3	532	8,520[2]
7....	3.2	1,445	8,500[2]
4....	12.2	1,106	8,460
3....	12.8	931	8,350
2....	6.6	934	8,370
2....	7.5	896	8,070
57....	7.9	1,101	9,356

(B) Crushing strength 6,000 to 8,000.

No. tested.	P. c. water 24 hrs.	Transverse mod.	Crsh. strength per sq. in.
7....	5.8	1,450	7,980[2]
2....	8.0	747	7,940[2]
2....	5.5	933	7,750
2....	5.8	1,171	7,670
2....	10.2	866	7,560
3....	6.2	1,269	7,510
2....	11.8	...	7,410
2....	7.5	937	7,360
2....	5.1	1,077	7,100[2]
3....	12.5	411	7,090
3....	10.7	668	7,030
3....	10.5	1,001	6,960
10....	8.2	978	6,850[2]
1....	10.5	866	6,710
1....	13.0	771	6,630
3....	11.6	906	6,480
1....	11.2	1,006	6,190
2....	13.8	870	6,020
51....	9.20	927	7,126

[1] None of these brick crushed under the maximum load given. [2] Some of these brick did not crush under the maximum load of the testing machine.

(C)Crushing strength,5,000 to 6,000.

No. tested.	P. c. water 24 hrs.	Transverse mod.	C. strength per sq. in.
2	13.6	696	5,240
3	11.6	1,392	5,710
1	13.7	900	5,280
1	14.3	985	5,410
2	15.3	952	5,170
2	16.1	1,264	5,720
1	16.1	681	5,000
1	12.0	473	5,220
1	10.3	947	5,000
1	17.0	592	5,210
2	8.1	832	5,060
17	13.50	875	5,275

(D)Crushing strength,under 5,000.

No. tested.	P. c. water 24 hrs.	Transverse mod.	C. strength per sq. in.
3	13.4	460	4,370
6	15.0	606	4,400
1	16.5	519	4,360
4	8.8	914	3,970
2	13.0	436	3,890
2	23.9	526	3,600
1	17.4	492	3,190
3	22.4	648	2,640
1	19.0	167	2,390
23	16.6	523	3,679

Summary.

Over 8,000	57	7.9	1,101	9,356
6,000 to 8,000	51	9.2	927	7,126
5,000 to 6,000	17	13.5	875	5,275
Under 5,000	23	16.6	523	3,679

The mean values given in the summary and footings are mere arithmetical averages, and take no account of the ranging number of bricks tested, as given in the first column. Had this been done the mean values would have been somewhat, but not greatly, different.

Tests of Paving Brick.

Rearranged in order of resistance to abrasion in tumbling.

No. of bricks tested.	T'mbl'g test, % lost.	P.c. water absorbed, 24 hrs.	Transverse mod.	Crushing strength —lbs. per sq. in.— Chipped.	Crushed.
2	4.8	0.7-0.6	2,415	7,720	8,150[1]
3	6.6	0.0-0.1	2,746	5,730	9,070[1]
10	6.9	1.1-2.2	2,695	7,570[2]	8,800[1]
10	7.5	0.1-0.5	2,096	4,580	7,490[1]
10	7.8	1.0-1.6	2,213	9,250[2]	9,320[1]
Arith. mean.	6.72	0.79	2,421	6,970	8,569[1]
8	7.9	0.4-0.8	2,431	5,340[2]	8,520[1]
10	8.0	1.2-1.8	2,466	8,440[2]	8,440[1]
8	8.6	0.6-0.3	1,718	6,140	10,860[1]
7	9.6	0.9-0.8	2,172	7,070[2]	9,030[1]
9	9.6	1.8-1.0	2,282	7,480	8,450[1]
Arith. mean.	8.74	0.96	2,214	6,894	9,060[1]
10	10.0	0.5-0.8	2,279	4,020	7,780[2]
5	11.3	1.2-0.7	1,492	4,780	8,540[1]
10	11.8	0.6-0.6	2,177	6,250	10,100[1]
10	13.0	2.7-2.0	2,281	7,490[2]	8,564[1]
10	13.7	1.1-0.5	2,244	6,580	9,810[1]
Arith. mean.	11.96	1.07	2,095	5,824	8,959[2]

Half the bricks tested were tumbled and half were broken and crushed, all having been first tested for absorption of water.

LETTERS TO THE EDITOR.

AMERICAN RECIPIENTS OF THE BESSEMER MEDAL.

Sir: In the interesting article in your issue of Nov. 15, describing the presentation of the Bessemer gold medal of the Iron and Steel Institute to Mr. John Fritz, you state that this is the third instance of the award to an American. You will, I trust, pardon my pointing out to you that in enumerating the names of these distinguished American metallurgists you have omitted to give the name of the first American recipient of the medal—the venerable Peter Cooper, the father of the iron trade of America, who was awarded the medal in 1879.

Instituted 21 years ago, the Bessemer gold medal has been presented on four occasions to American metallurgists, namely in 1879 to Peter Cooper; in 1882 to Alexander Lyman Holley; in 1890, to Hon. Abram S. Hewitt; and in 1893, to John Fritz.

Yours faithfully, Bennett H. Brough,
Secretary Iron and Steel Institute.

28 Victoria St., London, S. W., Nov. 26, 1894.

THE SURVEY FOR THE MISSISSIPPI AND LAKE SUPERIOR SHIP CANAL.

Sir: I notice in your paper for Nov. 29, page 439, bottom of middle column, an item which is entirely misleading. I presume a "fake" report first published in the "Superior Leader" is responsible for it. The survey of a route for the canal from Lake Superior to the Mississippi River is still in its preliminary stages. No reports have been made nor estimates submitted, nor is it probable that a complete report will be ready before next fall.

Very respectfully yours, Clinton B. Sears,
Major, Corps of Engineers, U. S. A.

U. S. Engineers' Office, Duluth, Minn., Dec. 4, 1894.

(The note referred to by our correspondent began: "According to press despatches." When our readers see an item in this journal especially credited to the newspapers, they may understand that the editors feel such doubts of the authenticity of the report that they prefer to disclaim responsibility for it.—Ed.)

WIDTH OF TIRES OF HEAVY WAGONS.

Sir: What is the tractive force, per ton, required to draw a wagon carrying a load of 15 net tons over a level, hard dirt or gravel road in good surface? Would 16 ins. width of tire be sufficient for such a wagon?

Salt Lake City, Nov. 21, 1894. B.

(According to Byrne's "Highway Construction," the resistance to traction on a level hard dirt or gravel road is 90 to 100 lbs. per ton. Probably it would be very considerably greater for such heavy loads per wheel and such broad tires as our correspondent proposes. Byrne advises a 6-in. tire for a load of two tons per wheel, but gives no widths for loads approaching those stated above. The proper width for such a heavy load will depend entirely on the character of the road, especially the nature of the foundation. If that were secure a 12-in. tire should be sufficient for such a load; but under the conditions which probably exist, 14 or 16 ins. would be preferable, and the latter should certainly be sufficient on any road in any way fit to carry such a heavy load.—Ed.)

RIVET SPACING IN PLATE GIRDERS.

Sir: Reading the chapter on plate girders in Prof. J. B. Johnson's "Modern Framed Structures," I happened to find there a little mistake. On p. 304, Mr. Bryan states that the pitch of rivets in flange angles is $p = \frac{rh}{S}$, S being the shear at any particular point, which is all right. But then he says, that because this shear practically increases uniformly from the center to the end, the spacing will also increase uniformly from the pitch found for the end of the girder to that found for the center. This is evidently not right, as S in the formula above stands as divisor and not as factor. The diagram, shown on p. 305, is consequently misleading, and—it must be said—not to the safe side. By plotting the proper curve between the two terminal values of p, you will find that where the diagram calls for 6-in. spacing, the rivets really ought to be 3½ ins. apart.

Yours truly, F. Sodemann.

New York, Oct. 17, 1894.

(We have referred the above letter to the authors of "Modern Framed Structures," who reply that our correspondent's criticism is well taken, and that the error will be corrected in future editions of the book.—Ed.)

NOTES AND QUERIES.

In answer to the query for a long multiplication table, several other correspondents besides the one whose letter was published in our issue of Nov. 22, refer to Crelle's "Rechentafeln" published by G. Remier, Berlin, Germany, extending to 1,000 × 1,000. Mr. Geo. H. Johnson, St. Louis, Mo., says he has used it for many years and in the third stereotyped edition has found only one error, viz., 265 × 881. For finding a number of products from a single two or three place multiplier, he says, the book connot be too highly recommended.

R. L. G., Greenlee, N. C., wishes to know where he can buy a pipe-scraping machine for removing incrustations from a 6-in. water main, similar to those described in Engineering News of Aug. 2, 1894. It appears from that article that the machines have been made by the Glenfield Co., Kilmarnock, Scotland. If any of our readers know where such machines can be bought in this country, we should be pleased to have them inform us.

THE VENTILATION OF THE SEPARATE SYSTEM OF SEWERS.

At the meeting of the New Jersey State Sanitary Association, at Trenton, N. J., last Friday, Mr. Parker N. Black, of Asbury Park, read a paper on the above subject, which we abstract as follows:

The necessity for ventilating sewers is caused by the objectionable gases given off during the decomposition of organic matter in sewers, and the movement of the air within the sewers due to changes in the amount and direction of pressure, which in turn are largely due to changes of barometer and temperature.

Regarding the use of house drains for sewer ventilation, the author says:

Ventilation should be accomplished entirely independent of the house drains. Provisions should be made to isolate every house as far as possible from the main sewer. It is unwise to trust to thorough workmanship in order to use the house drains as a vent for the gases which are liable to form within a sewer.

Mr. Black cites authorities to show that in sewers with proper grades and flushing, but little bad air may be expected, and that the air in sewers changes itself through ventilated manholes and other channels of communication with the outer air. If no ventilation were provided, Mr. Black states that any slight compression of air within a sewer would be liable to break water seals of traps. If, however, sufficient openings are made, he thinks sewers will ventilate themselves, there being a constant flow of air, in one direction or another, through perforated manhole covers, with a velocity of 1 to 5 ft. per second. When well ventilated, he says, the air in sewers will differ but slightly from that in well-ventilated buildings. Some of Mr. Black's final conclusions are as follows:

The simplest, cheapest and most certain method of ventilation is to provide openings to the sewer at sufficient intervals and in a manner that will not require connection with additional pipes or shafts. Trouble is more likely to arise from house drainage than from sewers properly constructed and ventilated.

A brief discussion of this paper will be found in our editorial columns.

DRAWING OFFICE APPLIANCES.*

By A. Wells Robinson, Chief Engineer, Bucyrus Steam Shovel & Dredge Co.

The drawing-board shown in Fig. 1 has a top 36 × 54 ins., glued up with saw-cuts on the back in the

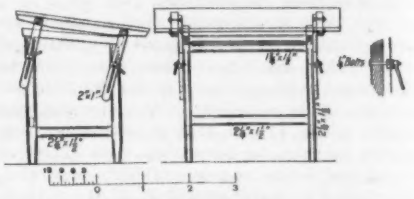

Fig. 1. Drawing Board.

usual way. It is of this size to suit standard sheets 23 × 36 ins., as described in paper No. 596, read June, 1894.** The top is made adjustable for slope and height by the slotted supports, as shown. This allows every draftsman to suit himself in this regard. The

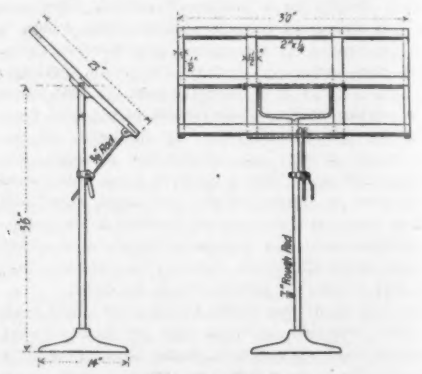

Fig. 2. Easel.

lower frame and legs are of oak, neatly chamfered. These tables complete were made by a plain carpenter and cost $7.50 apiece.

Each draftsman needs besides his board some convenient means of holding drawings for reference. The

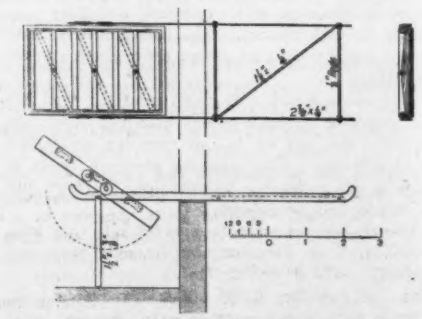

Fig. 3. Printing Frame.

easel (Fig. 2) fills this need. A number of drawings can be attached to the top edge by spring clothes-pins

* A paper read at the New York meeting of the American Society of Mechanical Engineers.

** The Relation of the Drawing Office to the Shop in Manufacturing: Trans. Am. Soc. M. E., Vol. XV., p. 965. Eng. News, June 14, 1894, p. 501.

or clips, and turned over the back as required. This easel is also "home-made" and cost $6.

The blue-print frame shown in Fig. 3 is 25 ins. by 38 ins. inside. It is carried on two pairs of small grooved wheels attached to the side, and upon which it is reversible, as shown. The tightening of the back is done by three cross-bars pivoted at their centers. The ends of the bars engage with cleats screwed to the inside of frame at a slight angle, so that they wedge the bars to any desired pressure on the back. It is not considered necessary to provide for a double-swing support so that the surface of the frame can be brought normal to the sunlight. This undoubtedly allows of quicker printing during morning and evening hours; but the saving is not great, and is obtained at the expense of simplicity. This frame cost about $18, including iron track and plate glass ⅜-in. thick.

THE INTERSTATE COMMERCE COMMISSION'S EIGHTH ANNUAL REPORT.

Advance sheets of this report, just received, give an interesting review of the present relations between the railways and the public. The following are the facts of chief interest:

The Commission and the Courts.—The United States Supreme Court has decided that the clause of the interstate law, requiring the U. S. courts to aid the commission in its inquiries, is constitutional; and that failure to obey a court order, requiring the giving of testimony, or the production of documents is punishable as contempt. The Supreme Court has also recognized in two recent cases the power of the separate States to regulate rates by legislative enactment or the mandates of commissions, the courts having only power to review such acts and decide whether such rates are so unjust or unreasonable as to work practical destruction to the property rights of the carrier.

Concerning criminal procedures under the law, the Commission holds that it is not a detective bureau or a public prosecutor, and says that it is the duty of shippers, railway officers and employees and citizens generally to make the law effective by informing the Department of Justice of cases of its violation. It is recommended that corporations be made indictable and liable to fine for infractions of the law committed by their officials, that the provision in the law making the carrier's agents liable to fine and imprisonment be retained, but that the similar liability of the shipper be removed.

Long and Short Haul.—This section of the law was designed to prevent discrimination between different trade centers, by the railways. The Commission urges that it is for the true interests of the carriers to promote this purpose of the law by a careful observance of its spirit. It might well have added that many of the cases of gross discrimination between places which have occurred, have been due to the fact that high officials of the railway have had private interests in a certain city or town, and, therefore, have used their influence in its favor, regardless of the interests of the railways.

Uniform Classification.—The Commission again urges that uniform classification be put in force and asks that it be given authority to make and put in force a uniform classification, prior to July 1, 1896.

Pooling of Freights.—The Commission does not oppose an amendment to the law removing the prohibition of pooling; but neither does it strongly favor it, which is perhaps wise on the whole, for there are plenty of demagogues who would seize any opportunity to denounce the Commission for "favoring the corporations." Its position is thus stated:

> We submit for the consideration of Congress that pooling without other remedial legislation is inadvisable. Pooling under conditions to be approved by the Commission and rendered capable of easy and direct regulations, with accompanying remedial legislation, we believe might be safely tried.

The Railway Strike of 1894.—The Commission did not meddle in this matter, partly because its interference would probably have been resisted by one or both sides; but it believes that it might properly undertake the investigation of such occurrences, and might well be explicitly empowered "to enter upon immediate investigation when strikes or lockouts are apprehended, to take the testimony of all persons, and have the aid of judicial process to compel such testimony and to enforce proper recommendation based upon the investigation."

Apropos of appeals by the railways to the interstate law, to remove obstructions by striking employees, the Commission says:

> That provisions intended to bring about general interchange of traffic with connecting lines on equal terms, and to compel the prompt forwarding of passengers and goods at reasonable rates, have been found so weak as to be incapable of forcing a railroad company to haul the loaded car of a connecting carrier at established local rates, and yet can be successfully invoked by a railroad company to restrain its employees from obstructing or in any way interfering with the prompt forwarding of interstate traffic over its own and conecting lines, is a condition of affairs which not plain people alone, but those supposed to be versed in the law, find it extremely difficult to understand. It may or may not be proper to use clauses of this law to regulate certain phases of railway labor, but if it is, then difficulties should not be found in the way of using the same clauses to compel connecting carriers to interchange traffic according to the intent of those who framed the statute.

We have also received the advance report of railway income accounts for the year ending June 30, 1894, prepared by the Interstate Commerce Commission's Statistician. The report covers 149,559 miles of railway, or about 85% of the total mileage of the United States. The following is the tabulated statement:

	Total.	Per mile of line.	Decrease from prev. year.
Gross earnings	$949,639,075	$6,350	$840
Pass. "	309,137,142	2,067	53
Fr't. "	617,958,498	4,132	774
Other "	22,420,208	.....	...
Operating expenses	643,428,331	4,302	574
Net earnings	$306,210,744	$2,048	$266

The number of passengers per mile of line was 86,253, against 83,809 in the previous year. The World's Fair traffic was responsible for this increase. The tons of freight carried per mile of line were 470,893, against 551,232 in the previous year.

The decrease in net earnings available for interest and dividends, on all the railways of the United States in the fiscal year, is estimated as exceeding $50,000,000. The financial accounts show that $28,032,631 was the deficit for the year, after paying interest and dividends, thus showing that dividends to this amount were either paid out of the accumulations of previous years, or were paid with borrowed money.

The report also shows the average receipts per passenger per mile and the average receipts per ton per mile for the year ending June 30, 1894, covering the mileage represented. Notwithstanding the decrease in traffic, there has been a decline in rates during the year, the average receipts per passenger, per mile, being 1.976 cts., as compared with 2.108 cts. in 1893. The average receipts per ton, per mile, were 0.866 ct., as compared with 0.878 ct. in 1893.

ELECTRICITY ON SHIPBOARD.*

When the enormous increase in the practical applications of electricity on land, during the past ten years, is compared with what has been done in the same direction on shipboard, one is inclined at first to conclude that the naval architect and engineer are behind their professional brethren on shore in appreciating and utilizing this form of energy. On shipboard electricity has been recognized as the proper agency for lighting, and apparatus and methods of installation have been so improved and standardized that the electric ship plant can now be relied upon for continuous and economical service. Beyond this, it cannot be said that electricity has been introduced to any considerable extent in marine installations, although the future gives promise of many new applications. As practically all other applications aboard ship are dependent upon the lighting plant, it is natural that the best engineering skill has been occupied in perfecting the latter, and as a result there have been developed for marine work a special type of generating set (engine and dynamo), special appliances (switches, junction boxes, cut-outs, stuffing tubes, water-tight globes and lanterns, etc.), special insulation for conductors, special methods of wiring, special forms of searchlights, and special men who may properly be called "marine electricians." The apparatus and appliances differ materially from those in use on shore, and must be used under service conditions entirely dissimilar. Salt water, salt air, steam and the excessive heat of ship boiler and engine rooms, would play havoc in a very short time with the best modern shore installation, as they have, in fact, with many of the early ship plants.

On war vessels the plant is properly considered as one of the vitals of the ship, and is always located below the protective deck, in a compartment by itself, near the boilers and as near the center of the ship as possible. In some of the larger war vessels abroad there are two plants, located in different parts of the ship, one for ordinary service (above the protective deck) and the other for service in action (below the protective deck). The practice of dividing the plant, however, is more expensive in first cost, as well as in operation and deterioration, and is bad on general principles; it has never been adopted in our service. In some merchant vessels and yachts the plant is located in the main engine room, to save expense in piping and in extra supervision and attendance. The presence of moisture, live steam or flying oil in the main engine room, however, is very injurious to electrical apparatus, and where possible the plant should always be located in a compartment by itself, near the boilers (to insure a short lead for the pipes) and near the engine room, so that the engineer on watch can, with a few steps, see that the plant is receiving proper attention. The ventilation of the room should be good, and the temperature should not be excessive. The modern dynamo, with its closed magnetic circuit, has no appreciable influence on a compass needle at a distance of 15 ft.

Engine and dynamo should always be direct coupled, and the best practice is to provide a fixed coupling, readily accessible, between dynamo and engine. A reserve capacity should always be provided, if space allows. In the navy, the present practice seems to provide a reserve of from 25% to 33⅓% of the full load duty of the plant, a separate unit furnishing the reserve. Thus, the full load service of the "New York" requires about 85 HP. dynamo capacity, which is supplied by two units, while a third, of 21 HP., furnishes the reserve.

Engines should be of the open type, compact and strong, with rigid frames, large bearing surfaces and liberal clearance in the cylinders. Vertical engines occupy much more less deck space than horizontal and are better adapted for ship service. There should be special provision for relieving the cylinders quickly of water. The engines should be fitted for atmospheric and vacuum exhaust and should be able to operate satisfactorily with considerable variations in pressure, since they may have to take their steam from either the main or auxiliary boilers. The speed should not vary more than 5% when full load is suddenly thrown on and off, for uniform speed of dynamo is very necessary for the satisfactory and proper operation of lights and motors. Vertical engines, whether simple or compound, should have two cranks, to insure smooth and quiet operation. With the present size of marine plants, the consumption of steam is so small, as compared with the total amount used for other purposes, that it has not been thought necessary or advisable to introduce compound engines; but as the uses of electricity increase in number and variety (thus necessitating larger generating plants), it will probably be found economical to introduce the compound type, as frequently used abroad.

The multipolar type of dynamo should be used, since it permits of slow armature speed, less weight, greater compactness and closed magnetic circuit. With the four-pole type, only two brushes are necessary, and this is a distinct advantage. The dynamos should be compound wound (insuring automatic regulation of the electro-motive force with change of load) and should be provided with a field rheostat to compensate for the change in the resistance of the field winding, when hot or cold.

Dynamos and engines should always be tested together, as a complete unit. The full load efficiency of the unit, as measured by the electrical horse-power at dynamo terminals, divided by the indicated horse-power of engine, should be not less than 80%; with the best types of marine sets it runs as high as 83 to 85%. This applies to a unit with simple engine. The curve of efficiency falls off at light load (the efficiency being about 75% at ¾ load, 70% at ½ load and 55% at ¼ load), and it should be arranged, therefore, that the units in operation at light loads should be loaded to at least 75% of the capacity.

The wiring of the vessel is the most difficult and expensive, as well as the most important part of the installation. With the wiring installed, many of the circuits are very inaccessible, and should a fault occur it is difficult to locate and still more difficult and expensive to remedy. The system generally used is the two-con-

* Abstract of paper presented by Lieut. S. D. Greene, U. S. N., at the meeting of the Society of Naval Architects and Marine Engineers in New York, Nov. 15 and 16. The proceedings of the meeting were reported in our issue of Nov. 22.

ductor, insulated metallic return system. In England experiments have recently been made with a concentric cable, where one conductor is placed concentrically outside and insulated from the other, in one cable. Such a cable has the advantage of materially reducing the labor of wiring a ship, while still retaining the advantages of a completely insulated, metallic circuit; but it is not wise, in the writer's opinion, to abandon our standard two-wire separate conductor system, until the success of the new method has been thoroughly demonstrated by several years' test at sea. The wiring should be divided in separate circuits, lights which are located in the same parts of the ship and which are ordinarily used at the same time being grouped on the same circuit. These several circuits are then carried back to the switchboard in the dynamo room, where they are so connected that they can be independently controlled. In large vessels the expense of running each circuit back to the switchboard becomes very heavy, and to reduce this "feeders" are led to certain predetermined "centers of distribution" where they are connected by means of suitable junction boxes to the circuit mains, which in turn light a certain section of the ship.

The present standard navy wire has no lead covering. It was found that in handling the wire the lead covering was very apt to become broken, thus allowing water to soak in between the covering and the wire and the ragged, broken edges were frequently driven into the insulation of the wire to such an extent as to "ground" the metallic conductor to the hull of the vessel. The insulation of the wire should be depended upon to prevent trouble (the best rubber covered wire only being used) and a good heavy braiding affords all the mechanical protection needed, beside the moulding. The circuits for the engine and firerooms, coal bunkers and exposed decks should be run in continuous iron tubes, having water-tight joints and an inner lining of insulating material, which method is successfully employed on shore in such places as breweries, dyeing establishments, and chemical works, where the conditions are as trying as they are at sea. The loss in the wiring should not exceed 5%, and the expense is not excessive if this loss is limited to 3%.

The electro-motive force of all U. S. naval plants is 80 volts. This standard has been adopted in order to permit the use of searchlights and incandescent lamps on the same dynamos without the interposition of too much dead resistance in the searchlight circuit; and as the searchlights are an important part of the military equipment of a naval vessel, the adoption of a non-commercial voltage for the plant may be justified. But in merchant vessels no such important reason exists, and the voltage should range from 100 to 120 volts, so that commercial incandescent lamps can be used.

The advantages of the electric motor are now too well known to need repetition, and with the improvement that has been made during the past two years in their durability and adaptability for special applications, there are many places aboard ship where they can replace the auxiliary steam engines, with a saving of expense in first cost and operation and in space and weight. For military purposes, they can be used to advantage as follows: 1, For ammunition hoists; 2, handling the turrets of battleships and monitors, and also the heavy guns in these turrets; 3, for torpedo discharge apparatus. Hydraulic or compressed air machinery has been largely used for this work in the past. Foreign navies have adopted electric motors for gun, turret and hoist work quite extensively, and a number of ammunition hoists have recently been ordered for our own ships; while the turrets of the new battleships will, in all proability, be operated entirely by electric motors.

For general purposes electric motors can be used to advantage as follows: 1, ventilating blowers; 2, portable drills; 3, portable pumps; 4, operating machinery in engineer's machine shop; 5, deck hoists, which are located at some distance from the boilers; 6, operating valve of steam steering engine, or even replacing end engine; 7, opening and closing water-tight doors; 8, driving ice machinery.

There are certainly auxiliary steam engines that it is inadvisable to attempt to replace with electric motors; thus the auxiliaries in the engine and boiler room spaces (including blowers, ash hoists and certain spar deck hoists) require only short lengths of steam piping, and the conditions of service in the boiler and engine rooms are very trying to a motor; again the anchor engine requires from 40 HP. to 50 HP., and if a motor is used, the generator and wiring capacity of the plant must be considerably increased, while the motor is needed occasionally only, and cannot be used for other purposes.

Such a general introduction of electric motors as here recommended necessitates an increase in the capacity of the generating plant of from 30 to 60 HP. (the heavy turret-turning machinery having its own plant), depending upon the number of motors used, but this increase can be provided for in the existing dynamo rooms of all larger vessels, and the advantages derived warrant the additional expense. A modern vessel is filled with steam and exhaust pipes running to the auxiliary engines; where they pass through living spaces they are a great discomfort; they are in constant need of repairs, and they are a menace to life in case of accidental bursting or breaking. Electric wires take up much less room, do not easily get out of order, and do not injure any one if they do get out of order. The electric motor is cleaner, quieter, lighter and more compact than any other form of motor. They are in daily use on shore for many of the purposes enumerated, and there is no reason why their use should not be equally successful on board ship.

Searchlights have been in use on war vessels as a military weapon of offense and defense for several years, but their use as an aid to navigation is recent. Vessels now passing through the Suez Canal use their searchlights, and so make as rapid progress at night as in the day time. Vessels plying between New York and Savannah use their searchlights in running up the Savannah River at night, and frequently save 12 hours' time from dock to dock in so doing. The Sound steamers throw the beam of their lights overhead in a fog, and the location of the vessel is indicated by a well-defined luminous spot in the fog. The searchlight is frequently used for coaling ship or making repairs at night.

The French have tried the experiment of placing the projector close to the water line, either by mounting it at a lower deck port, or by hanging it from an overhead support outside the ship. Theoretically, the area of contact of the beam of light on the water is increased by this arrangement, and this is doubtless true in practice when the ship is at anchor in a harbor on a calm night. If the attempt, however, is made to use the projector in this position with the ship under way, it does not seem possible that it can escape injury from the waves nor that the beam of light will not be frequently shut in by the intervening seas.

Several range finders have been devised both here and abroad, but by far the most complete apparatus is that invented by Lieut. Bradley A. Fiske. U. S. N. (Eng. News, Jan. 31, 1891). This beautiful instrument, after tests extending over a period of five years, has just been officially approved and adopted by the Navy Department, and it has been adopted by several foreign governments as well. The following extracts from an official report of the commanding officer of the "San Francisco" show what it will do in actual service:

> In January last, when at Pernambuco, Brazil, I sent to the Department a tabulated record of the errors of the range finder as determined in the various ports where the true distances could be gotten from the charts. The average error of all the observations was about 0.6% per 1,000 yds. Since that time I have always made use of the range finder at target practice, and in going into and out of port and in coasting. The range finder is thoroughly adapted to ship use, as is shown by the fact that its whole care and service are in the hands of three apprentice boys. These boys keep it in order, and go to it as their station at general quarters, getting under way and anchoring, and whenever the word is passed, "Man the range finder." The range finders keep in order with almost no care whatever. There is a transmitter in the conning tower—one reading instrument in the starboard gangway—another reading instrument on the poop. The quiet and orderliness of target practice would be much increased if two reading instruments were added —one for the port gangway and one for the forecastle.

For night signals, the navy has recently adopted an improved form of the Ardois system, suggested by Lieut. A. P. Niblack, U. S. N. Four double lanterns, each lantern being colored half red and half white, are strung on a jackstay at the mizzenmast, the interval between the lanterns being 12 ft. An incandescent lamp is placed in each half of each lantern and connected by cable to a signal stand mounted on deck as desired. Various combinations of red and white lights are then flashed by a suitable switch at the signal stand and the lights are burned until the signal is reproduced on all the answering ships. Another switch is used to "blink" the upper light, thus indicating some special code signal. This system is rapid and very satisfactory up to distances of three to five miles. For "wig-wag" signaling, between two vessels, a very neat, double, masthead lantern has been developed, the red and white lights being flashed in succession by a suitable key. A "multiple fiber" incandescent lamp has been recently brought out in England for use with these masthead lanterns, the individual fibers, or filaments, being so fine that they lose their incandescence immediately the current is cut off. With the usual single filament lamp, there is an after-glow, when the circuit is opened, which is sometimes confusing in rapid signaling. The searchlight provides an excellent means of long-distance signaling, the beam of light being thrown overhead and waved to right or left. It has been reported that English war vessels have communicated successfully in this way, in Chinese waters, when more than 50 miles apart.

Electric firing circuits for firing the guns and torpedoes of war vessels will undoubtedly be used in the future; these circuits are so arranged that indicators at each gun and in the conning tower show when the gun is laid and ready for firing.

The French navy has recently adopted an electric log, the invention of Admiral Fleurials. A set of revolving vanes on the log impart, through worm gearing, motion to an ivory disk mounted in the log, and a spring makes contact with metallic plates placed at intervals on the rim of this disk. As this contact takes place, a bell is sounded aboard ship, once for every 24 revolutions of the vanes. The interval between signals is arranged 11 seconds for 8 knots, 8.8 seconds for 10 knots, 4.4 seconds for 20 knots, and is, therefore, of sufficient length to prevent errors. To indicate fractions of a second, the usual sand glass has been displaced by a pendulum indicator which beats at intervals of 0.2 second, and which is started at the moment of taking an observation.

Another French invention, by Lieut. Bersier, of the French navy, which will probably be introduced aboard ship, is the steering compass, to keep a ship on her course automatically. The electric spark of a Ruhmkorff coil is made to unite a pointer on the circumference of the compass card with either one of two semi-cylindrical, metallic plates, which are electrically insulated from each other and from the side of the compass box or binnacle. The coil is placed a few yards from the compass, and is supplied by an alternating current of from two to three amperes. The induced current of the secondary coil reaches the pivot of the compass, through a flexible wire, and passes thence to the aluminum capsule that carries the sapphire, and follows along an aluminum wire or pointer which forms a radius of the north pole of the compass. As the ship deviates to the right or left of her course, the current leaps (through a distance of about an inch) from the pointer to the right or left hand insulated plate in the binnacle, and thence flows through one of two electromagnets, which, in turn, close the circuit, in one direction of rotation or the other, of a small 150-watt motor. The shaft of this motor is keyed to the shaft of the rudder motor, which moves the rudder in the direction required to bring the ship back to her course. It is reported that the compass card is entirely uninjured by the current or spark, and that the device has been tested in squadron practice for two months with complete success.

Rapid communication, or exchange of orders, between distant parts of a large vessel is quite a problem. Electric gongs and bells are useful as calls, and speaking tubes are largely used. On the "New York" there is a speaking tube "exchange" below the protective deck and under the conning tower. A better system would be to have a direct telephonic connection between the conning tower and such other points as are desired, without any "exchange" at all. Such systems are now installed in many large office buildings and industrial establishments, and give great satisfaction. Telephones have been tested aboard ship and found to be entirely reliable, and an order can be given clearly by telephone that could not be understood at all through a speaking tube, especially when there is much noise or confusion at either or both ends of the line.

Electric engine revolution counters and direction indicators, thermostatic coal bunker indicators and helm indicators have recently been successfully developed. They are simple in construction and easy to operate. Some of these appliances, devised by Lieut. Fiske, are now being installed on board the "New York." The mechanical engine room telegraph signals now used for transmitting orders from the bridge to the engine room are a great improvement over the old gong and bell pull, but an electric telegraph signal will soon displace the mechanical device. Several such instruments have already been made and tested, both in this country and in Europe, with satisfactory results. A set of these instruments is also being installed aboard the "New York."

The objections to storage batteries aboard ship are their great weight, and the presence of an acid solution, which gives off acid fumes. The weight is being gradually diminished with successive improvements; and the batteries can be fitted with water-tight covers to prevent slopping, while the fumes can be removed by proper ventilation. They have the advantages for ship use that there is no moving machinery about them, they need not necessarily be placed in the dynamo room, they can be charged at any time during periods of light load, and when the heavy load comes on they can be used to help out the plant. They will probably find a proper field of usefulness aboard ship in the future.

The development of alternating current apparatus suitable for the simultaneous operation of incandescent lights, arc lights and induction motors, has emphasized the advantages of this type of apparatus, and has greatly extended its sphere of usefulness on shore. The alternating current, induction motor has all the advantages of the direct current motor, with the great additional feature of having no commutator or brushes.

Considerable attention has been attracted in England to the possible use of steam turbines, directly coupled to dynamos. Their great compactness and simplicity

of construction make them particularly suitable for marine plants, while their comparative high speed permits of the use of a very cheap dynamo; for in dynamo construction the cost of manufacture varies almost inversely as the speed. Several shore plants using the direct connected steam turbine have been installed in England, and the reports thus far are very favorable. If they prove reliable in service, some sacrifice of steam efficiency can well be afforded with their introduction aboard ship, on account of their many compensating advantages.

TESTS OF BUILDING AND PAVING BRICKS.

We are indebted to Mr. E. S. Fickes, of Steubenville, O., for the accompanying voluminous and valuable table of tests of brick carried out under his direction, and covering paving bricks and building bricks of standard makes from all parts of the country. So much information about American bricks was, perhaps, never before obtained by a single experimenter or collected in a single table, and because of this exceptional completeness it has a special value as a record. Such general conclusions as can safely be drawn from it as to the physical qualities of good and bad bricks, we have endeavored to present in another column, and therefore will not repeat here. The conditions under which the tests were made, as stated to us by Mr. Fickes, were as follows:

The entire work of testing was carefully done, every precaution being taken to keep the condi-

TESTS OF PAVING AND BUILDING BRICKS MADE BY E. S. FICKES, STEUBENVILLE, O.

Place of manufacture.	Dimensions.	Weight.	No. bricks tested.	P. c. of water absorbed. Immersed 1 hr.	P. c. of water absorbed. Immersed 24 hrs.	P. c. of water absorbed. Total absorption.	Time required for total absorption.	Modulus of rupture. $R=\frac{3Wl}{2bd^2}$	Compression. P. c. whole brick compressed.	Compression. Pressure per sq. in. at failure.	Pressure per sq. in. at crushing.	P. c. of weight lost in 1 hr. of tumbling.	Material used in making.	Process of manufacture.	Remark
	Inches.	lbs. oz.					Hrs.	lbs. per sq. in.		lbs.	lbs.				
Logan, O.	9.0 x 4.0 x 3.1	8 12.0	5	0.3	0.5	0.7	62	2,066	48.8	4,580	7,490**	..	Semi-fire clay.	Machine-made, salt glazed.	Broken before absorption (test, 5th five unbroken
" "	....	8 10.5	5	0.1	0.1	0.3	48	....	..	....	....	7.5	" "	" " " "	Broken before absorption.
Zanesville, O.	8.9 x 4.2 x 3.1	9 5.4	5	0.5	0.8	1.2	62	2,279	48.4	4,620	7,780**	..	Semi-fireclay	Auger mach., rpsd, salt glzd	Broken before absorption.
" "	....	9 7.1	5	0.2	0.5	0.8	58	....	..	....	....	10.0	and scale mixed.	Unbroken.	
Corning, N. Y.	8.0 x 4.1 x 3.1	6 4.1	5	1.2	1.6	1.8	48	2,213	49.8	9,250**	9,320*	..	Blue shale.	Auger mach., side cut, rpsd.	Surface slightly glazed.
" "	....	6 5.7	5	0.6	1.0	1.2	43	....	..	....	....	7.8	" "	" " " " "	
New Cumberland, W. Va.	8.4 x 4.2 x 2.5	6 15.8	5	1.0	2.2	3.1	91	2,095	49.0	7,570**	8,800*	..	Semi-fireclay.	" " " " "	Two ridges on one flat side.
" " " "	....	7 1.3	5	0.5	1.1	2.0	125	....	..	....	....	6.0	" "	" " " " "	
" " " "	8.3 x 4.2 x 2.5	6 12.4	5	0.8	1.8	3.2	134	2,496	50.8	8,440**	8,440*	..	" "	" " " " "	No ridges.
" " " "	....	6 13.1	5	0.6	1.2	3.0	163	....	..	....	....	8.0	" "	" " " " "	
Galesburg, Ill.	8.0 x 3.7 x 2.1	5 5.7	5	0.4	0.6	0.7	51	2,177	49.2	6,250	10,100**	..	Shale.	" " end cut.	
" "	....	5 6.5	5	0.5	0.6	0.8	62	....	..	....	....	11.8	"	" " " "	
Clearfield, Pa.	8.3 x 4.0 x 2.4	6 5.5	5	..	2.0	2.8	120	2,281	52.2	7,490**	8,564**	..	Semi-fireclay.	" " side cut.	
" "	....	6 4.3	5	0.9	2.7	2.9	48	....	..	....	....	13.0	" "	" " " "	One brick broken tumbling.
Syracuse, N. Y.	8.1 x 3.8 x 2.1	5 3.1	5	0.2	0.5	0.7	43	2,244	50.0	6,580**	9,810*	..	Shale.	" " 3 side, 2 end cut.	One broken tumbling.
" "	....	5 3.4	5	0.7	1.1	1.7	77	....	..	....	....	13.7	"	" " " "	" " "
Franklin, Pa.	8.2 x 4.0 x 2.4	6 9.5	4	0.5	0.8	0.9	36	2,172	49.8	7,070**	9,030*	..	"	" " side cut.	Four only in compres'n.
" "	....	6 9.4	3	0.6	0.9	0.9	36	....	..	....	....	9.6	"	" " " "	
Pittsburg, Pa.	8.5 x 4.2 x 2.5	6 15.1	5	0.4	1.0	2.7	142	2,282	49.8	7,480**	8,450*	..	Semi-fireclay.	" " " "	
" "	....	7 0.1	4	0.4	1.8	4.1	204	....	..	....	....	9.6	"	" " " "	
Barrington, R. I.	7.7 x 3.6 x 2.3	5 7.3	4	0.2	0.3	0.6	54	1,718	50.5	6,140	10,860*	..	Clay.	" " " "	
" "	....	5 7.6	4	0.3	0.6	0.8	48	....	..	....	....	8.6	"	" " " "	
Canton, O.	8.4 x 4.2 x 2.4	7 1.8	4	0.3	0.8	1.2	48	2,431	50.6	5,340**	8,520*	..	Shale.	" " " "	
" "	....	7 0.7	4	0.2	0.4	0.5	48	....	..	....	....	7.9	"	" " " "	
" "	8.1 x 4.0 x 2.5	6 15.1	2	0.1	0.1	0.1	12	2,746	51.0	5,730	9,070*	..	"	" " end cut.	
" "	....	6 14.2	1	0.0	0.0	0.0	00	....	..	....	....	6.6	"	" " side " repsd.	
" "	8.5 x 4.1 x 2.5	7 6.0	1	0.3	0.6	1.0	72	2,413	53.0	7,720	**8,150*	..	"	" " " "	
" "	....	7 5.2	1	0.4	0.7	1.3	72	....	..	....	....	4.8	"	" " " "	
Malvern, O.	8.5 x 4.0 x 2.5	6 7.5	3	0.4	0.7	1.8	104	1,492	51.5	4,780	8,540*	..	Semi-fireclay.	" " " "	Two only in compression
" "	....	6 7.6	2	0.5	1.2	3.4	144	....	..	....	....	11.3	" "	" " " "	
BUILDING BRICKS.															
Cincinnati, O.	8.2 x 3.9 x 2.6	6 3.4	2	4.6	5.8	6.4	96	1,171	51.0	4,600	7,670		Yellow clay.	Auger mach., end cut.	Hard arch brick.
" "	8.3 x 4.3 x 2.7	6 4.8	2	12.5	13.6	14.2	72	696	49.0	2,920	5,240		" "	" " " "	Front brick.
" "	8.3 x 4.1 x 2.7	6 5.4	3	10.7	11.6	12.3	88	1,392	52.3	2,930	5,710		" "	" " " "	Sidewalk pavers.
Washington, D. C.	8.3 x 4.0 x 2.1	5 6.0	10	6.9	8.2	8.5	48	978	50.3	3,520	6,580**		Clay.	Soft mud machine.	Hard common.
Steubenville, O.	8.3 x 4.0 x 2.4	6 4.1	7	4.7	5.8	6.4	69	1,459	47.7	6,580	7,980**		Shale and clay.	Auger mach., side cut, repsd	" "
Rochester, N. Y.	7.8 x 3.6 x 2.2	4 2.2	4	11.7	12.2	12.2	30	1,166	50.5	5,550	8,490		Clay and sand.	Soft mud machine.	
" "	7.6 x 3.6 x 2.2	4 0.5	2	11.4	11.8	12.1	48	....	100.	5,240	7,410		" " "	" " "	Crushed on edge whole.
" "	7.6 x 3.6 x 2.2	4 1.0	2	11.1	11.6	11.7	36	....	100.	3,710	4,140		" " "	" " "	" " end "
Cleveland, O.	8.2 x 3.8 x 2.3	4 4.4	1	17.1	17.4	16.8	48	492	44.0	3,040	3,190		Yellow clay.	" " "	kiln 44 h. 2d course from top.
"	8.1 x 3.8 x 2.2	4 5.1	1	15.9	16.5	16.8	48	519	51.0	2,310	4,360		" "	" " "	8th " " "
"	8.1 x 3.7 x 2.2	4 5.1	1	13.3	13.7	14.2	72	900	48.0	1,670	5,280		" "	" " "	12th " " "
"	8.0 x 3.7 x 2.2	4 5.1	1	13.8	14.3	14.8	48	985	50.0	2,570	5,410		" "	" " "	19th " " "
"	8.1 x 3.7 x 2.2	4 2.4	2	13.4	13.8	14.4	60	870	51.5	4,140	6,020		" "	" " "	24th " " "
"	8.2 x 3.8 x 2.2	4 3.6	2	14.8	15.3	15.6	60	952	48.0	3,150	5,170		" "	" " "	30th " " "
"	8.1 x 3.7 x 2.2	4 3.4	2	15.9	16.1	16.2	60	1,294	49.0	2,590	5,720		" "	" " "	Arch.
Baltimore, Md.	8.2 x 4.0 x 2.1	4 14.5	4	8.0	8.8	9.1	48	914	50.0	2,990	3,970		Clay.	" " "	Hard common.
"	8.2 x 3.8 x 2.2	4 13.6	2	7.8	9.0	9.4	48	....	100.	1,840	2,490		"	" " "	Crushed on edge whole.
"	8.2 x 4.0 x 2.2	4 13.9	2	8.0	9.4	9.8	48	....	100.	2,480	4,660*		"	" " "	" flat whole.
"	....	4 14.8	2	7.7	8.4	8.6	60	....	100.	3,020	3,720		"	" " "	" on end whole
"	8.2 x 4.0 x 2.1	4 14.8	2	7.7	8.4	8.6	60	....	100.	3,020	3,720		"	" " "	Hard common.
Fishkill, N. Y.	7.8 x 3.4 x 2.3	3 13.4	3	11.8	12.5	12.8	48	411	53.3	4,170	7,090		"	" " "	Crushed on edge whole.
"	7.9 x 3.4 x 2.2	3 13.5	2	13.7	14.4	14.8	48	....	100.	4,820	5,840**		"	" " "	" on flat whole.
"	7.9 x 3.4 x 2.2	3 13.8	2	12.8	13.6	13.6	48	....	100.	3,960	5,630*		"	" " "	" on end "
"	7.8 x 3.4 x 2.2	3 15.8	2	11.6	12.2	12.5	48	....	100.	2,480	2,880		"		
New Haven, Conn.	7.9 x 3.5 x 2.3	3 14.9	1	15.6	16.1	16.1	24	681	51.0	1,430	5,000		Red clay and sand.		Salmon.
"	7.8 x 3.5 x 2.3	4 2.5	3	12.3	12.8	12.9	40	931	49.3	5,160	8,350		" " " "		Middle bench of kiln.
"	7.6 x 3.4 x 2.2	4 0.2	2	4.5	5.5	5.8	48	933	49.5	2,400	7,750		" " " "		Very hard.
"	7.7 x 3.4 x 2.2	4 0.2	1	10.8	11.2	11.5	48	1,066	53.0	1,870	6,190		" " " "		Arch.
Philadelphia, Pa.	8.3 x 3.5 x 2.4	4 10.8	1	11.4	12.0	13.1	96	473	47.0	3,950	5,220		Clay.	Auger mach., end cut.	Salmon.
"	8.1 x 3.8 x 2.3	4 14.4	3	9.3	10.5	11.8	96	1,001	52.6	3,480	6,960		"	" " " "	Light front.
"	7.9 x 3.5 x 2.3	4 13.3	3	5.4	6.2	7.2	96	1,269	51.0	2,130	7,510		"	" " " "	Arch.
"	8.3 x 4.1 x 2.2	5 1.0	1	10.2	10.5	10.5	24	866	48.0	4,630	6,710		"	Hand made.	Phila. stretcher.
Troy, N. Y.	8.0 x 3.6 x 2.3	4 3.5	6	14.7	15.0	15.1	40	606	49.3	2,880	4,400		" and sand.	Soft mud machine.	Hard common.
Milwaukee, Wis.	8.3 x 4.0 x 2.3	4 0.4	3	21.6	22.4	22.9	56	648	46.7	1,890	2,640		"	" " "	Common buff.
"	8.0 x 3.9 x 2.4	4 4.2	2	22.2	23.9	24.0	48	526	50.5	3,340	3,900		"		Pressed buff.
Erie, Pa.	8.2 x 4.0 x 2.3	5 3.8	2	12.6	13.0	13.0	36	436	50.5	3,060	3,890		" and shale.	Dry press.	No. 6 press.
"	8.3 x 3.9 x 2.3	5 7.5	1	9.6	10.3	10.3	24	947	54.0	2,730	5,000		" " "	" "	" 7 "
"	8.2 x 3.8 x 2.2	5 2.4	2	9.8	10.2	10.4	48	866	52.0	6,650	7,560		" " "	" "	" 8 "
"	8.2 x 3.9 x 2.2	5 8.9	1	6.9	7.4	7.4	24	1,359	51.0	7,930	9,150*		" " "	" "	" 9 "
"	8.0 x 4.0 x 2.2	5 2.6	2	7.9	8.3	8.3	36	895	50.5	5,940	8,890		" " "	" "	" 10 "
"	8.0 x 4.0 x 2.2	5 4.2	2	6.2	6.8	6.8	24	674	53.5	8,820**	8,820*		" " "	" "	Sidewalk pavers.
St. Louis, Mo.	8.5 x 4.2 x 2.4	5 4.9	1	18.5	19.0	19.6	72	167	49.0	1,820	2,390		"	" "	Salmon.
"	8.4 x 4.0 x 2.2	4 11.1	1	16.0	17.0	17.6	48	502	50.0	4,730	5,210		"	" "	Medium red.
"	8.3 x 4.0 x 2.2	4 12.3	1	14.3	15.3	15.9	72	512	48.0	5,000	5,750		"	" "	Dark red.
"	8.3 x 3.8 x 2.3	4 12.7	1	12.4	13.6	14.1	72	771	51.0	4,380	6,630			" "	Straight hard.
"	8.0 x 3.9 x 2.3	5 4.6	1	5.2	5.8	6.0	48	1,745	51.0	9,490*	9,490*		"	" "	Sidewalk paver.
"	8.4 x 4.0 x 2.3	5 5.6	1	11.4	12.3	12.6	48	532	50.0	4,380	8,520		"	" "	No. 5 press.
"	8.3 x 4.0 x 2.3	5 4.7	1	10.6	10.8	11.1	72	851	49.0	8,770	9,260*		"	" "	" 6 "
"	8.3 x 4.0 x 2.4	5 5.6	1	10.9	11.0	11.3	72	1,015	51.0	5,720	8,930*		"	" "	" 7 "
"	8.2 x 4.1 x 2.2	5 2.0	1	11.3	11.5	1.8	72	803	47.0	6,080	9,490*		"	" "	" 8 "
"	8.2 x 4.0 x 2.3	5 4.3	1	10.9	11.0	11.4	48	1,106	52.0	7,490	8,770*		"	" "	" 9 "
"	8.2 x 4.0 x 2.3	5 7.5	4	9.4	9.8	10.1	60	1,086	51.2	8,860**	8,860*		"	" "	Dark red.
Columbus, O.	8.4 x 4.0 x 2.3	5 11.6	2	7.6	8.1	8.4	48	832	50.0	3,730	5,060		Fireclay and shale.	" "	Terra cotta front.
"	8.6 x 4.2 x 2.3	5 14 2	2	6.0	6.5	7.2	72	1,528	49.0	7,060	8,040*		"	" "	Cream front.
"	8.4 x 4.0 x 2.3	5 10.6	2	7.2	7.5	7.8	60	896	51.0	7,600	8,070**		Mixtures.	" "	Gray "
"	8.4 x 4.0 x 2.3	5 13.0	2	7.2	7.5	7.7	60	937	50.5	5,540	7,360		"	" "	Mottled "
Sioux City, Ia.	8.2 x 4.0 x 2.2	5 1.4	3	10.8	11.6	11.8	40	606	50.3	5,060	6,480		Semi-fireclay.	" "	Fancy light front.
"	8.2 x 4.0 x 2.34	15.8	3	14.7	13.4	13.4	24	400	52.0	3,170	4,670		"	" "	" " "
"	8.4 x 4.0 x 2.3	5 3.6	3	9.8	10.7	11.1	64	668	51.0	3,060	7,030**			" "	
Philadelphia, Pa.	8.2 x 4.0 x 2.3	5 5.5	2	7.2	8.0	8.3	72	747	50.0	4,540	7,940		Mixtures.	" "	Fancy mottled front.
"	8.2 x 4.0 x 2.2	5 4.4	2	8.7	9.4	9.6	48	947	51.5	5,800	8,080*		"	" "	" " "
"	8.0 x 4.0 x 2.2	5 5.6	2	3.5	3.6	3.7	48	1,308	49.5	4,840	9,500*		"	" "	" " "
"	8.2 x 4.1 x 2.2	5 11.9	2	6.0	6.7	6.9	60	971	49.5	7,940**	8,980*		"	" "	" " "
"	8.3 x 4.0 x 2.2	5 11.2	2	5.9	6.6	6.8	48	934	49.5	3,340	8,370**		"	" "	" " "
"	8.3 x 4.1 x 2.2	5 11.1	2	4.5	4.7	5.0	48	1,224	49.0	6,580**	9,010*		"	" "	" " "
"	8.2 x 4.0 x 2.2	5 5.5	2	4.0	4.2	4.4	48	1,378	48.0	6,080	9,710*		"	" "	" " "
"	8.0 x 4.0 x 2.2	5 6.7	2	5.1	5.8	6.0	60	1,234	49.5	7,320**	9,380*		"	" "	" " "
"	8.0 x 4.0 x 2.2	5 5.2	2	4.5	5.1	5.4	48	1,077	51.0	4,920	7,100**		"	" "	" " "
"	8.0 x 4.0 x 2.2	5 6.2	2	4.4	5.0	5.1	36	1,006	50.0	7,620	9,380*		"	" "	" " "
Bradford, Pa.	8.0 x 4.0 x 2.3	5 13.9	8	5.9	5.9	5.9	57	1,295	51.4	7,110**	9,030**		Shale.	" "	Red front.
Philadelphia, Pa.	8.3 x 4.0 x 2.4	5 6.2	9	10.2	11.2	12.1	104	769	50.4	3,290	5,560		Clay.	Repsd., probably hand made.	Red. Phila. press.
Pittsburg, Pa.	8.1 x 4.0 x 2.4	6 1.7	7	1.9	3.2	3.4	58	1,445	52.0	5,700	8,500**		Fireclay.	Auger mach., side cut.	Buff front.

Compression tests marked (*) are such as did not crush or fail, as the case may be, under the maximum of 150,000 lbs. pressure.
Compression tests marked (**) are such as only some of the bricks, which are averaged, did not crush or fail, as the case may be, under the maximum pressure.

tions uniform and so render the results comparable.

As soon as the bricks were received they were marked and measured to the nearest tenth of an inch, the dimensions being placed in column 2 of the table. They were then dried for at least 48 hours at a temperature of about 180° F., and if at all damp, much longer.

After drying, they were weighed and placed under water for one hour, again weighed, then soaked for 23 hours longer and again weighed. The soaking and weighing were continued at intervals of 24 hours, until the bricks showed less than 0.1 oz. increase in weight per day. The increase in weight was taken as the amount absorbed and the percentage the increase in weight was of the dry weight is placed in columns 5, 6 and 7 of the tables.

Before weighing the wet bricks, the free water on the surface was allowed to evaporate, so that the brick, though damp, would not wet the fingers.

Such bricks as were not to be tested for abrasion or crushed whole, were broken by flexure in an Olsen testing machine on knife-edges 6 ins. apart, the brick being laid flat and the load being applied midway by a third knife-edge.

To secure an even bearing at least ⅛ in. of pasteboard was placed between each knife-edge and the brick. From the center breaking load thus determined, the modulus of rupture, as given in column 9, was obtained.

As the capacity of the testing machine used was only 150,000 lbs., most of the crushing tests were on half bricks. In order to secure an even bearing for crushing, the test pieces were given smooth plane surfaces of plaster of paris, not over ⅛ in. in thickness, and allowed to harden for 30 days. The area used to find the pressure per sq. in. is the mean of the two pressed surfaces. In the case of half bricks the per cent this area is of the area had the brick been whole, was found and is in column 10. Had it been possible always to have had an exact half-brick, this per cent would always have been 50. The pressure in column 11 was obtained from the reading of the machine when the first signs of cracking were observed, and that in column 12 from the maximum reading. Many of the specimens were uncrushed, as is noted in the table.

The abrasion tests were made by placing from 6 to 13 bricks in an iron foundry rattler, 20 ins. in diameter by 32 ins. long, running 34 revs. per minute and containing about 150 lbs. of stars, weighing less than an ounce each. The tumbling lasted one hour and the per cent the loss of weight was of the whole weight before tumbling is in column 13. The remainder of the table needs no further explanation. The irregularity of size is notable, and is commented upon elsewhere.

SUSPENDING STREET CAR TROLLEY WIRES IN CHEMNITZ, GERMANY.*

The city of Chemnitz has adopted the trolley system of electrical propulsion, but the wires are hung from house walls instead of from poles. The system is simple, cheap, convenient, easily adjustable, and free from much of the ugliness inseparable from the network of wires necessary for the trolley. The streets here through which the cars wind their way are wider than Washington St., Boston, or Westminster St., Providence. I state this to anticipate the objection so often urged that European streets are narrower than ours. The method of stringing the wires is by rosettes fastened into the woodwork or walls of the houses, from which project hooks, to which the wires are attached. In wooden walls, large screws are turned into the wall; in case of stone, a long jagged iron is driven in and cemented. These are then tested with at least seven times the weight that they are expected to bear. Owners of houses, without exception, preferred to allow the use of their houses free to having a post on the sidewalk. The company holds signed and sealed documents from house-owners giving a year's right to the use of the walls for hooks, and a further agreement to give a year's notice for removal. The system has now been in operation for six or eight months, and has proved satisfactory and successful. No one has given notice to remove the hooks.

The tracks are (the law says they must be) level with the pavements. This costs the company more money, but is infinitely better for the public. Accidents to wagons, carriages and vehicles of all kinds are consequently very rare. The gage is narrow. The cars run 7½ miles per hour in the heart of the city, and 11 miles per hour in the suburbs. The increase in traffic since the introduction of electricity is said to be fully 60%; this, too, notwithstanding a strenuous opposition to the change manifested for years, and a year of exceedingly hard times.

The cars have no conductors. The motorman is the only person on board who represents the company. By doing away with conductors, the company saves annually $11,000. The fare is only 10 pfennigs, or a trifle less than 2½ cts. on all routes, including transfers. Attempts to evade payment of fare are rare. Fare boxes are attached to front and rear parts of the car, hence no one has any excuse to offer as to difficulty of getting forward.

Public opinion is divided between the trolley (overhead) and the underground system now operating in Budapest. It was claimed, and pretty satisfactorily proved, that in northern cities, where snow falls heavily and lies on the ground a long time, not only is the trolley best but the underground system is not satisfactory. I did not learn that any opinion was expressed as to the merits of the storage system.

*Abstract from a consular report from Mr. J. C. Monaghan, U. S. Consul at Chemnitz.

Paving and repaving on a singularly inefficient plan seem to prevail in Brooklyn, N. Y. On some of the residence streets the paving blocks are taken up, relaid on a little fresh gravel and then covered with about 3 ins. of dirty gravel, so that for weeks the street is intolerably dusty or impassably muddy, while all the neighboring streets are made dirty, and when the relaid pavement reappears, it is sometimes seen to be in worse condition than before it was disturbed. The open space beside the new station of the Brooklyn Bridge was treated in the same way (the engineers not being responsible for such treatment, however), with the result that wind, rain and carriage wheels carried the mud and dust in all directions, and for some months the streets within a few blocks of the bridge were in a miserably dirty condition, until all the gravel had been washed or blown away.

Trolley car speed is limited to 8 miles per hour, by an order of the Council of Tonawanda, N. Y. The penalty of $25 is imposed for each violation of this ordinance.

Nuisances on Newtown Creek, Brooklyn, have been ordered abated by Gov. Flower, in accordance with recommendations from the New York State Board of Health. Brooklyn and Long Island City are prohibited from discharging sewage into the creek, and are required to build sewers to the East River. Several rendering establishments along the creek are ordered to discontinue operations. Fat rendering on the creek is prohibited, except at such distances from the East River as will permit the discharge of condensing water directly into the river.

A more complete sewerage system for Newark, N. J., is under consideration. Recently the board of health asked the street and water commissioners to appoint a committee to confer with the mayor, the president of the council and a committee of the board of health for the purpose of devising a plan for a systematic sewering of the city. The board of street and water commissioners instructed its committee on sewers to confer as requested, and has directed the city surveyor to prepare a map showing every sewer in the city and the area served by each trunk sewer.

A combination of storage battery interests has been effected by the acquisition by the Electric Storage Battery Co., of Philadelphia, Pa., of all the rights and patents of the Consolidated Electric Storage Co., the General Electric Launch Co., the Electric Launch & Navigation Co. and the Accumulator Co., together with the storage battery patents of the Brush Electric Co., of Cleveland, O., and the General Electric Co. This will put an end to the long-continued litigation over storage battery patents in this country.

The present condition of the Chicago Drainage Canal enterprise is thus described in the report of President Frank Wenter, who has just been re-elected to that office: The 28 miles of canal, from Chicago to Lockport, including the entire length of deep cutting, is all under contract, and more than 40% of the material in the channel has been excavated. Of the original 14 sections first let in the summer of 1892, only six sections remain in the hands of the original contractors; the other eight were either relet or assigned to new parties, and two of the six remaining sections were readjusted. These changes were due to a failure to comply with the contracts, in not making satisfactory progress. Up to Nov. 1, 1894, the sum of $6,079,259 had been paid out, and Mr. Wenter is confident that the work will all be completed in 1896. The Sanitary District owns 6,284.38 acres of land, and 500 acres more are to be added to complete the land purchases. The main drainage canal and its levees, highway crossings, etc., require 1,480 acres; but the remaining 5,000 acres are unavailable for rental purposes, as they are greatly encumbered by spoil banks. The total estimated cost, including canal, controlling works, superintendence, etc., is now about $27,000,000. On Nov. 1 last, 6,179 men were employed on the work; 142 men were in the engineering department, and about 60 in the other departments, including 47 policemen. The engineering department proper has cost $570,720 from the inception of the work to Nov. 1.

The Hamilton Canal Boat Co., a corporation recently organized at Hamilton, Ohio, proposes to use the trolley system for motive power on the Miami canal, and expects to maintain a speed of 14 miles per hour without injury to the canal banks.

Judge Truax, of the Superior Court of New York city, has upheld as constitutional the act of the New York Legislature of April, 1894, providing that all stone of any description used in state or municipal works in the state of New York must be worked, dressed or carved either within the boundaries of the state or within the municipality where it is to be used. He also upholds as valid another law of the last legislature providing that none but citizens of the United States shall be employed by persons contracting with the state of New York or any municipality in that state for the execution of public works. The decisions were rendered in a suit instituted by James Quinn, a contractor, and seriously affect contractors in obtaining this class of materials from other states, and in the use of alien labor. The law relating to stone is absurd and likely to interfere also with interstate commerce legislation, and if carried to the United States courts, will doubtless be reversed.

The Chinese "tael," so frequently used as a unit of currency by the press at the present time, is actually a unit of weight equal to 579.84 English Troy grains, or about 1.2 oz. Troy. The Chinese currency system, says Vice-Consul Hunt, of Hong Kong, is based upon a certain weight of silver, and not upon any standard coin. Any one calling for $1,000 in coin in Hong Kong would have weighed out to him 717 taels weight of probably "chopped" Mexican dollars. The system, however, is not as inconvenient to the stranger as may be supposed, for both Chinese and European banking is well developed in Hong Kong, and large payments are usually made by checks upon the Hong Kong and Shanghai banks, which have $6,000,000 of their notes in circulation. There is also a plentiful supply of subsidiary coinage, of 20, 10 and 5-cent pieces, which pass by count.

An object-lesson in road improvement comes from Kingston, N. Y. The Ulster Co. Road Association last fall appealed to the Board of Supervisors, asking that body to take some effective action upon the practical improvement of main roads. The appeal was in vain and the Road Association then raised money and, under a competent superintendent, finished three miles of the Saugerties Road. This section is well macadamized and is now superior in surface to any street in Kingston, though it was a deep stretch of sand before improvement. The Board of Supervisors has expressed its delight with the new road and it remains now to be seen what effect this practical exhibit will have upon their future action.

A dirigible torpedo has been invented by Lieut. N. J. L. T. Halpine, U.S.N. As described, the thin copper hull is cigar-shaped; has a spear-like arrangement at the front end and rudder and propellor at the rear, the latter driven by a 4-HP. electric motor. In the forward part of the hull is a detachable case holding the explosive. What Lieutenant Halpin proposes to do, though no actual test seems yet to have been made, is as follows: When the spear-head strikes the net usually surrounding a warship in action, the meshes strike two projecting arms, which release the case, holding about 175 lbs. of dynamite, or a proper charge of gun cotton. The spear head remains fixed to the net and the case is suspended from it by a chain and sinks below the net. The contact of the water with a bit of potassium fires a rocket which impels this case forward and upward, the purpose being to make it strike the ship's bottom, and 40 seconds after release from the torpedo hull the explosion is fired. The hull, meanwhile, is connected by a light wire with, and is under control of, the operator on shore, or on another ship, and is supposed to back away and return to its starting point. A dry-land test has been made in Boston of a working model. How it will act against a ship is a later story.

The official report to the shareholders of the Chignecto Marine Transport Ry. Co., Ltd., dated October, 1894, has just been received, and contains the following information regarding that suspended enterprise: The time limit fixed by the Canadian government

for the completion of the ship railway expired on July 1, 1894. An extension of this time is consequently necessary to obtain the annual subsidy of $170,602 for 20 years, granted by an act of the Canadian Parliament in 1883. The original Canadian company undertook to complete the work by July 1, 1889, but the promoters were compelled to go to London to finance the enterprise, and finding that the time fixed was too short the Canadian government extended it to July 1, 1892. Work was commenced in October, 1888, but unforeseen difficulties arose, and the government, on request, again twice extended the time of completion to July 1, 1893, and finally to July 1, 1894. The work is now nearly three-fourths completed, and $3,500,000 has been expended upon it. Every effort of the managers is now being directed towards securing from the Canadian government another extension of time, and the continuance of the subsidy as a basis for raising the further sums required to complete the work. The original share capital was $2,000,000, and this was issued; but the $3,500,000 debenture capital provided for could not be issued until 20% of the whole cost of the work had been expended. This did not happen until 1890, when the promoters encountered the financial crisis of that year. They could only obtain subscriptions for $1,250,000, and the suspension of work followed towards the end of 1891, owing partly also to the entanglement of the ship railway contractors with public works in the Argentine Republic, which were stopped when the panic came.

Steel rails, in 1895, are to be sold at $22, and $23 per ton to Western buyers, according to the agreement of the steel rail manufacturers, as announced in the "Iron Age." The price given is for all rails of 45 lbs. and upward per yard. This is a decrease of $2 per ton on the present ruling price.

It is reported that the Baltimore & Ohio R. R. Co. is about to organize a very large transfer station at Brunswick, a small town on the main line, near Harper's Ferry. Much property has already been secured, and large shops are to be erected there. All freight is to be transferred at this point for all East and West destinations, and the 1,500 men, now at the Locust Point transfer station, will go to Brunswick.

The Manchester Canal Company, in the last eleven months, has earned in all about $420,000, or $85,000 less than the working expenses, says a London despatch to the New York "World." This account agrees with the statement of the London "Financial News," lately commented upon in this journal.

The building of an American "war-bridge" was described by Prof. Geo. W. Plympton, in a paper read before the last Convention of the American Association for the Advancement of Science. The bridge across the Gauley River, in West Virginia, was destroyed by the Confederates, in 1861, and by orders from General Rosecrans it had to be rebuilt. The late John W. Murphy, of Murphy-Whipple bridge fame, submitted original plans for a suspension bridge, which were accepted. The spans were 120 ft. and the old bridge piers and abutments were in place. Mr. Murphy ordered wire cables; built towers of timber, and on the suspended cables swung loosely framed trusses made wholly of planks. From this truss the floor was swung and the whole bridge was finished in 22 days under the fire of the enemy. Mr. Murphy admitted to one of the editors of this journal, in one time describing this same bridge, that the structure when completed was somewhat flimsy in appearance, and General Sigel, doubtful of its stability, ordered Murphy to test it himself by leading a squad of cavalry in a charge over the bridge. Murphy obeyed, somewhat reluctantly; the bridge stood the test and was then used for the passage of the army.

A ship-canal, 29½ ft. deep, is projected by the Russians to connect the Baltic with the White Sea. The distance is 186 miles, and part of the way there is already a depth of 10 ft. The line would follow the River Neva to the Ludago and Onega lakes; leaving by the Onega River it would reach Lake Langers; then the line would traverse Lakes Matko, Telekino and Wyg and follow the Wyg River to the White Sea. The entire cost is estimated at $6,400,000.

A large combination of manufacturers of fire-clay sewer pipe is said to have been effected at Pittsburg, Pa., under the name of the Central Sewer Pipe Co., including 28 firms representing a capital of about $2,000,000. Other firms are also expected to join the combination, and harmonious relations are said to have been established with the sewer pipe trust at Akron, O., composed of manufacturers of other than fire-clay pipe, which latter combination represents about $3,000,000. The effect of the combination will be to raise prices, and the manufacturers claim that they are now selling their product at cost. Mr. F. H. Coleman, of the United States Fire Clay Co. and the Ohio Sewer Pipe Co., is president of the new company.

The report comes from Philadelphia that the officers of the Pennsylvania R. R. Co. are contemplating the conversion of the Camden & Atlantic City Ry. into a trolley line. This railway, about 60 miles long, was the first railway connecting Camden, N. J., with Atlantic City and was once very profitable. Two parallel railways have divided the traffic, and trolley lines touching the towns on the line are contemplated. The proposed line, rumor has it, would forestall this latter scheme; but the rumor must be taken for what it is worth.

The Susquehanna & Tidewater Canal, built in 1836 between Havre de Grace, Md., and Wrightsville, Pa., along the Susquehanna River, is to go into the hands of a receiver. The canal has defaulted upon three half-yearly payments of $10,000 each to the state of Maryland on a $1,000,000 mortgage. In 1872 the canal was leased to the Philadelphia & Reading R. R. Co., but that road surrendered its lease last spring. The debt of the canal company is over $2,000,000, and there is a rumor that it may be bought by the Reading Railroad and used as a roadbed for a railway to the coal-mining regions of Pennsylvania.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago—Existing Roads.

CLEARFIELD, CONEMAUGH & WESTERN.—It is stated that negotiations will be completed within a few days for building about 32 miles of this railway in Pennsylvania, and that the engineers will soon commence the final location of the line between Irvona and Johnstown, 45 miles. Ch. Engr., Samuel Brugger, Fleming, Pa. Pres., S. J. M. McCarrell, Harrisburg, Pa.

GENESEE & WYOMING VALLEY.—Tracklaying on the Caledonia branch of this railway, about 12 miles in length, is expected to be completed by the middle of this month. Gen. Man., Chas. Q. Freeman, Retsof, N.Y.

PENNSYLVANIA.—The Philadelphia "Times" states that the Ebensburg & Black Lick branch of this road, from Ebensburg to Vintondale, 12½ miles, may be extended 23 miles further to a connection with the Western Pennsylvania. This would shorten the time between Cresson and Pittsburg. Preliminary lines have been run up the west branch of Black Lick Creek to near Kinninel and from there down Yellow Creek to Homer City. The country through which the branch runs is very wild.

Projects and Surveys.

BATAVIA & NORTHERN.—The Batavia & Northern, to build a steam or electric railway from Batavia to Albion, N. Y., 18 miles; capital stock, $352,000; and the International & Oak Orchard Harbor, to build from Albion to Oak Orchard Creek and Lake Ontario, 10 miles; capital stock, $170,000; were incorporated at Albany, N. Y., Dec. 5. Directors, Geo. A. Wingate, Jacob Cole and Wm. H. Hazzard, Brooklyn, N. Y.; Robt. Avery, Jas. H. Cox, New York. Ernest Wende, of Buffalo; O. C. Steele and D. D. Lent, of Batavia; and D. S. Beckwith, of Albion, are also directors of the Batavia & Northern, and D. S. Beckwith, C. E. Hart, Wm. Hallock and Geo. E. Barrell, of Albion, of the International & Oak Orchard Harbor.

BENVENUE GRANITE.—Bids are asked in our advertising columns for grading 8,650 ft. of railway for the Benvenue Granite Qarries, Middletown, Conn. The work will include about 6,000 cu. yds. solid rock excavation, 5,000 cu. yds. earth excavation, and 7,500 cu. yds. embankment.

BURLINGTON & HINESBURG.—The name of the Chittenden County Ry., projected from Burlington to Hinesburg, Vt., 12 miles, has been changed to the Burlington & Hinesburg. The final survey was commenced by Frank O. Sinclair, Ch. Engr., Burlington, Vt., Dec. 4.

WELLSTON BELT & ELECTRIC.—This company was incorporated a year ago to build a railway from Jackson, O., to McArthur Junction, by way of Glen Roy and Coalton. The Chillicothe, O., "News" states that the road will probably be built next year and that electricity will be used to carry passengers to and from the mines and steam for all freight. The directors include Harvey Wells, J. C. Clutts, and H. S. Willard, Wellston, O. Ch. Engr., Harry Gates, Columbus, O.

Southern—Existing Roads.

PICKENS.—The American Engineering Co., Atlanta, Ga., has the grading completed, bridges built and ties laid on this railway, 35 miles in length, all in Pickens county, S. C. We are informed that tracklaying will be completed within 30 days.

SOUTHERN.—C. M. Bolton, Ch. Engr., Washington, D. C., writes us as follows: There is no work of any consequence being done on our line at present, nor has any been laid out for the near future. We are making some small additions to the shops at Knoxville and Atlanta, and replacing seven spans of Howe truss bridge with steel structures between Washington and Lynchburg.

Projects and Surveys.

JELLICO & AUGUSTA.—The Knoxville, Tenn., "Tribune" states that Col. Albert E. Boone, Zanesville, O., is behind a scheme for a new railway from the Jellico coal district through Knoxville to Augusta, Ga., where it will connect with the Port Royal & Augusta for Port Royal, S. C. L. D. Dillon and Chas. H. Brown, Knoxville, Tenn., are said to be interested. terested.

Northwest—Existing Roads.

DULUTH, MISSISSIPPI RIVER & NORTHERN.—I. N. Gray, Ch. Engr., Swan River, Minn., writes us that the northern terminus of this road has not been decided. The company has built 37 miles from Swan River north to Hibbing and has built 12 miles of branches for lumbering purposes this fall. There is now under construction a one-mile branch to the Mahoning Iron Co.'s mine No. 3. Winstod Bros., Minneapolis, have the contract for this work and also for stripping the mines.

Projects and Surveys.

SUPERIOR, EASTERN & SOUTHERN.—Incorporated in Wisconsin to build a railway from Superior to Lake Michigan; capital stock, $3,000,000; incorporators, Frank Geele, Mayor of Sheboygan, Wis.; J. D. Cameron, Chicago; John Hunner, State Treasurer of Wisconsin. Press reports state that the new road will be about 400 miles in length, and will run through the counties of Douglas, Bayfield, Taylor, Lincoln, Oneida, Marathon, Marinette, Shawano, Langlade, Price, Waupaca, Outagamie and Sheboygan. Pres., Frank Geele, Sheboygan; Vice-Pres., R. H. Laire, St. Louis; Secy. and Gen. Man., J. D. Cameron, Chicago; Treas., John Hunner, Madison; Attys, A. C. Prescott and Judge Simon Gillen, Sheboygan.

Southwest—Projects and Surveys.

VINING COAL.—The Vining Coal Co., Austin, Tex., is reported as interested in a railway 25 miles in length to be built to mines in Coleman county. It is expected that the construction will be commenced next month.

WICHITA FALLS.—It is reported that J. A. Kemp & Co., Wichita Falls, Tex., have been awarded the contract for building this railway from Wichita Falls to a connection with the Missouri, Kansas & Texas at Henrietta, a distance of about 20 miles, and are now receiving bids for the equipment, etc.

Rocky Mt. and Pacific—Existing Roads.

NORTHERN PACIFIC.—An officer of this company is reported as stating that the branch to Lewiston, Idaho, will be completed as soon as possible after the permission of the court is secured. The work was commenced before the receivers were appointed.

SOUTHERN PACIFIC.—Wm. Hood, Ch. Engr., San Francisco, writes us that the coast line contracts were let some time ago to McMurtrie & Stone, contractors, for 50 miles south of San Luis Obispo. The grading and masonry are well under way for 25 miles and six miles of track are laid.——Press reports state that the right of way has been practically secured for the proposed seven-mile extension into Pasadena, Cal., recently noted.

Foreign.

MEXICO.—A press report from Jiminez, Mex., states as follows: The concession recently granted to a company for the construction of a railway from this city to Parai has been approved by Congress, and the work of construction will soon begin. From Parai the road will be extended to the rich mineral district of Batopilas, and thence to the Pacific Coast. The road connects with the Mexican Central at this place.

STREET AND ELECTRIC RAILWAYS.

AUGUSTA, ME.—Press reports state that a project is being considered to construct a standard gage electric railway between this city and Waterville by way of East Vassalboro, Getchell's Corner and Vassalboro, a distance of 20 miles. It is proposed to construct a branch from East Vassalboro to Weeks Mill, and narrow gage line from Waterville to Weeks Mill to connect with the Wiscasset & Quebec Ry. S. C. Libby, Waterville, is interested.

NEWTON, MASS.—It is reported that a plan is being considered for the extension of a street railway to connect Newton Highlands and Newton Center with West Roxbury and Jamaica Plain.

TAUNTON, MASS.—Sylvanus Thomas, Treas. Taunton St. Ry. Co., is reported as stating that this company is considering a scheme to consolidate the New Bedford, Fall River and Taunton St. Rys. and to have them equipped with electricity. For this purpose A. P. Smith, Fall River, and R. A. Soule, New Bedford, will apply for a franchise for the Taunton & Fall River St. Ry. Co.

MIDDLETOWN, CONN.—The Middletown Electric Ry. Co. has voted to apply for permission to extend its line to Meriden by way of Westfield, to Cromwell and to Durham. Supt. A. E. Goss.

WESTPORT, CONN.—The Westport & Saugatuck Horse Ry. Co. is reported as about to petition the legislature for permission to equip its line with electricity and also to extend it.——The Norwalk St. Ry Co. is preparing to extend its line, according to reports.

BATAVIA, N. Y.—The International & Oak Harbor Ry. Co. has been incorporated to build a steam or electric line from Albion along Orchard Creek to Lake Ontario, a distance of 10 miles; capital stock, $175,000; and the Batavia & Northern Ry. Co. has been incorporated to build a steam or electric line between this city and Albion, a distance of 18 miles; capital stock, $325,000; directors of both companies, G. A. Wingate, W. H. Hazzard, Brooklyn; J. H. Cox, New York; D. S. Beckwith, Albion; Ernest Wade, Buffalo; O. C. Steele, Batavia.——A. B. Wilgus, representing the Batavia St. Ry. Co., about to be incorporated, has been granted a franchise to construct the proposed electric line.

CORNING, N. Y.—The Corning & Painted Post Electric Ry. Co. has been incorporated with a capital stock of $100,000.

ELMIRA, N. Y.—It is reported that it is proposed to construct an electric railway between this city and Waverly.

JAMAICA, N. Y.—The Jamaica Electric Ry. Co. has been granted a franchise.

MOUNT VERNON, N. Y.—The North Mount Vernon Horse Car Co. has been sold to a New York syndicate, which is going to operate it as an electric railway, according to reports. Horace Loomis, Pres. of the People's Bank, negotiated the sale.

NEW BRIGHTON, N. Y.—The Staten Island Electric R. R. Co. has been incorporated to construct a street railway about 22 miles in length, in and between New Brighton, Edgewater, Northfield and Southfield; capital stock, $1,250,000; directors, G. B. H. Harvey, M. L. Bouden, John A. Hilton, John T. Mills, Eugene R. Leland, A. J. Hummell and Henry Haggerty, New York.——The Midland Railway Co. has been granted permission to equip its line with electricity and to extend it, the improvements to be completed by July 1.

TROY, N. Y.—The Troy City Ry. Co. is securing the consent of property owners between Cohoes and Green Island, preparatory to the equipping of its road with electricity.

WHITE PLAINS, N. Y.—The New York & Elmsford R. R. Co. has applied for a franchise to build an electric railway in two streets.

MORRISTOWN, N. J.—The question of constructing a street railway to connect this city with the towns in this vicinity is being discussed. The use of the tracks of the Rockaway Valley R. R. to Mendham and other points on that road have been offered the company. J. E. Melick is interested.

NEWARK, N. J.—The Passaic & Newark Electric Ry. Co. has petitioned the committee of Franklin township for permission to construct its line through that township. Max Kaufman, Township Clk.

TRENTON, N. J.—The Trenton Traction Co. has been incorporated with a capital stock of $500,000. It is proposed to control the Trenton electric lines and connect by a loop with the electric railway now being constructed between New York and Philadelphia. Directors, Thomas Barr and James Ball, Newark; E. J. Moore, Philadelphia; Wm. S. Stryker, A. R. Kuser, John L. Kuser, R. S. Woodruff and Hugh H. Hamill, of this city; F. M. Eppley, West Orange; B. Jenkins, Newark; F. W. Roebling, Trenton.

ALLEGHENY, PA.—It is reported that an electric railway will be built from East Ohio St. to Spring Hill. H. W. Aklers and H. W. Hempenheide are interested.

CARLISLE, PA.—W. F. Sadler, Jr., Ch. Engr., Greensburg, Jeannette & Pittsburg St. Ry., writes us that this electric railway is projected from Greensburg to Irwin, by way of Jeannette, Pitt Manor and other small towns, a distance of 12 miles. Some rigit of way has been secured, and the company is waiting to sell bonds. Contracts are to be awarded about Feb. 15. The work will be let to one contractor to build and equip the entire road. Pres., W. F. Sadler.

GREENSBURG, PA.—The Greensburg, Jeannette, Turtle Creek & Pittsburg Electric St. Ry. Co. has been granted a franchise and right of way through this town. The entire line is to be completed in 18 months, according to reports.

OXFORD, PA.—Press reports state that the Pennsylvania Traction Co. has notified Chief Burgess T. K. Stubbs that it is the company's intention to make this town the terminus of a proposed electric railway beginning at a point near West Chester and running through Marshallton, Unionsville, Kennett Square, Toughkenamon, Avondale, and thence into Oxford. A large corps of engineers will commence the work of locating the proposed new line next week.

PITTSBURG, PA.—The Washington Incline Plane Co. was incorporated Dec. 10 to carry passengers and freight from Grand Ave. to a point between Smithfield and Wood Sts. Treas., C. Cramer.

POTTSTOWN, PA.—Press reports state that the Ringing Rocks Electric Ry. Co., which now runs to Ringing Rocks, three miles north of Pottstown, is making preparations to extend its line to Boyertown by way of Limerick and Coldbrookdale turnpike. The extension will be completed early next summer.

ROYERSFORD, PA.—J. H. Dager, C. E. Dager, Chas. Goshen and Frank O'Niel, representing the Norristown Trolley Co., were in town last week surveying the proposed route to Royersford from Norristown by way of Collegeville and Trappe. The ties are ready to be placed from Norristown to Collegeville, according to the reports.

BALTIMORE, MD.—Press reports state that contracts have been let for grading the Washington-Laurel section of the Washington & Baltimore Boulevard Co.'s electric line between Baltimore and Washington and contracts for building the road will certainly be let by Jan. 1. The line will have a double-track the entire distance, says the "Manufacturers' Record," and will cost about $30,000 a mile; 80-lb. steel rails will be used. There will be four power-houses, costing $60,000 each, with boiler batteries of 1,000 HP., and the current will be generated by 500-volt dynamos. The rolling stock on the Washington-Laurel division will consist of 10 motor cars, each of 100 HP. and capable of maintaining an average speed of 60 miles an hour, or of covering the distance between Washington and Baltimore in less than 40 minutes. The power stations will be constructed of brick with metal roofs and iron structural interior work. Between Laurel and Washington 12 passenger stations are to be built. The trolley sstem will be used throughout, and between Laurel and Washington about 3,000 poles for feed wires, etc., will be erected, or nearly 6,000 on the entire route. The cost of the entire line from Baltimore to Washington will be considerably more than $1,000,000, of which $500,000 will be spent on the Laurel division. Pres., David M. Newbold; Edward Hambleton and Robt. Carswell, Baltimore, and the Widener-Elkins-Hambleton syndicate are also interested.——The Walbrook, Gwynn Oak & Powhattan Electric Ry. has been purchased by the Traction company. The company proposes to equip its Waverly line with electricity and extend it to Clifton Park, the work to be commenced early in January. Gen. Man., W. A. House, Jr.; Ch. Engr., F. H. Hambleton.

CRISFIELD, MD.—O. P. Byrd, Secy., writes us that right of way and capital have been secured but no surveys made for the proposed electric railway which is to border on Pocomoke Sound and will be 2½ miles in length. Contracts will probably be awarded about Jan. 1 and operations will begin at once. Pres., Thos. S. Hodson, Baltimore.

KENSINGTON, MD.—The Chevy Chase & Kensington Electric Ry. Co. has been granted a franchise to construct a line on several streets.

WASHINGTON, D. C.—The Metropolitan St. R. R. Co. has awarded the following contracts for equipping its Ninth Ave. line with an electric underground system: The General Electric Co., New York, for all the electric generators at the power station, which will be located on 4½ St. between O and P, at the company's power house, which is already completed, and for all the motors and appliances necessary to perfectly install the road electrically; Pennsylvania Steel Co. for all the steel rails, and for all the slot rails and electical conductor bars; Campbell & Zell, Baltimore, for boilers. Contracts have also been awarded for a number of cars. Bids for the engines were opened Dec. 8, and bids for foreign and domestic cement, which were to have been opened Dec. 7, will be opened Thursday. As soon as the cement contract is awarded, the specifications for building the conduits will be placed in the hands of contractors for estimates. These specifications are all ready, and a large number of contractors will be invited to bid. This work, by the terms of specifications, will be required to be finished at the rate of 1,000 ft. a day, so that when the ground is once opened, the entire conduit will be laid in six weeks. These improvements are estimated to cost about $700,000. Pres., S. L. Phillips; Supt., W. E. Lowry; Ch. Engr., A. N. Connett.

MOUNDSVILLE, W. VA.—Wareham & Hughes, Beaver Falls, Pa., have been awarded the contract for building the Benwood-Moundsville Electric Ry. The road will be about nine miles long, and will cost about $200,000.

NEW ORLEANS, LA.—The New Orleans Traction Co. has issued bonds for 20 miles of extensions, according to reports. Gen. Man., H. M. Litteil.

BURNSIDE, KY.—It is reported that there is talk of constructing an electric railway between this place and Monticello, to cost $90,000 to $120,000.

PADUCAH, KY.—The Paducah Electric Co., recently incorporated, has purchased the Citizens' St. Ry., and it is reported will change it to a trolley line and make other improvements. Eibridge Palmer and F. Rowland are interested.

CLEVELAND, O.—The Cleveland City Ry. Co. is considering plans to extend its line to Nottingham, a distance of four miles. Secy., J. B. Hanna.

NILES, O.—The council is reported about to advertise for bids asking for the lowest rates of transportation between this city and Youngstown. Several applications have been made to the council for a franchise for an electric railway between these cities.

SIDNEY, O.—The Sidney Electric Ry. Co. has been incorporated to build an electric railway from this place to Loramnes and Minster; capital stock, $100,000; incorporators, Charles Timens, J. H. Thedick and J. H. Wagner.

ELWOOD, IND.—Press reports state that J. E. Jeffries, of this city, and Congressman-elect Henry H. Anderson, have been granted a franchise for a street railway at Alexandria. They will build six miles, connecting all the principal factories, and will meet the Elwood lines at Orestes, thus uniting the two cities.

GREENWOOD, IND.—Grafton Johnson, Pres. Indianapolis, Greenwood & Franklin R. R. Co., writes us that H. L. Smith, 165 Park Ave., Indianapolis, is the promoter and C. E. Loss, Pullman Bldg., Chicago, the contractor for building this electric line, which will extend from Indianapolis to Franklin, a distance of 20 miles. Right of way has been secured for three-fourths of the distance.

INDIANAPOLIS, IND.—The Citizens' St. R. R. Co. has voted to extend its electric lines to Garfield Park. At a meeting to be held in January additional extentions will probably be discussed.

DETROIT, MICH.—The construction of an electric railway from the dividing line between Wayne and Oakland counties, through Birmingham and Pontiac to this city is being planned. E. W. Voigt and James A. Randall are interested.——The Citizens' St. Ry. Co. is making arrangements to equip its Grand River and Gratiot Ave. lines with electricity. It is probable that the change will be made by spring. Pres., J. M. Edwards; Treas., R. T. Wilson, banker, New York.—— The Peck-Everitt syndicate has been granted a franchise, and a company to be known as the Detroit Ry. Co. will soon be incorporated, according to reports. Work will be commenced at once.

TRAVERSE CITY, MICH.—The Traverse City, Peninsula & Old Mission Electric R. R. Co. has been incorporated to construct a line 20 miles in length; capital stock, $160,000; incorporators, J. G. Rainsdell, L. K. Gibbs and W. P. Krotson,

WAUKEGAN, ILL.—The Bluff City Electric Ry. Co. has been organized with a capital stock of $200,000; Pres., Homer Cooke; Treas., T. H. Lindsay; Secy., S. D. Talcott.

APPLETON, WIS.—The Wisconsin Inter-Urban Ry. Co. is soon to be incorporated to build an electric railway to connect with Neenah, Menasha and Kaukauna, by C. C. Aldrich, Thomas A. Scott, St. Louis; J. T. Sherman, Lake Geneva; and F. C. Raton, Chicago. As soon as the company is incorporated work will be commenced on the construction and the street railway owned by the Appleton Edison Electric Light Co. will be purchased, according to reports.

OSHKOSH, WIS.—Press reports state that work has been commenced on the Oshkosh Electric St. Ry., the awarding of the contract for which was noted in our issue of last week. According to the terms of the franchise eight miles must be completed within four months and 20 miles before Jan. 1, 1896. The promoter of the enterprise is J. K. Tillotson, Toledo, O. He is backed by Chicago capital. A stock company with capital of $1,000,000 is being formed to put in not only a line here but an inter-urban road from Oshkosh to Kaukauna.

SIOUX CITY, IA.—Plans are being discussed for equipping the South Morning Side road with electricity and extending it to Sergeant Bluffs.

RAPID CITY, S. DAK.—J. W. Fowler, Vice-Pres. Hot Springs & Wind Cave R. R. Co., writes us that surveys have been made and right of way has been obtained for constructing the electric line from Hot Springs to Wind Cave, a distance of 10 miles. The capital has been secured and contracts for the construction will be let in January. Ch. Engr., James M. Baldwin, Hot Springs, S. Dak.

SEDALIA, MO.—D. C. Metsker, Secy., Treas. and Gen. Man. Sedalia & Brown Springs Electric Ry. Co., incorporated Nov. 24, writes us that the proposed railway will be 2½ miles in length and will be an extension of the Sedalia Electric Ry., Light & Power Co.'s line, which company will build and lease the road at a sufficient sum to pay the interest on $80,000 of bonds to be issued on the new road. The construction will probably be commenced early in the spring. The new company owns 120 acres of land at Brown Springs, abounding in medicinal springs. Pres., W. E. Sterne, Topeka, Kan.

ST. JOSEPH, MO.—It is reported probable that an electric railway will be built to St. George and Lake Contrary next spring, either by the St. Joseph Traction & Lighting Co. or by a new company that may soon apply for a franchise.

ST. LOUIS, MO.—The Forest Park Scenic Road Co. has applied for a franchise to build an electric railway in Forest Park. W. T. Moore, E. G. Savage and Geo. Moran are interested.

SAN FRANCISCO, CAL.—Property owners on Kearney St. have petitioned the board of supervisors to permit the Market St. Ry. Co. the right to extend its electric line on that street. Edward Holland, Mgr. Commercial Hotel, has been securing signatures.

OAKLAND, CAL.—I. W. Bishop, receiver for the Piedmont Cable Road, has been granted permission to change the road to an electric line and to borrow $8,000 for that purpose.——The Oakland, San Leandro & Heywards Electric R.R. Co. has applied for a 25-year franchise on either 12th St. or Central Ave., at exploration of the present franchises.

NOTRE DAME DE GRACE, QUE.—The Park & Island Ry. Co. has been granted a franchise to extend its electric railway and light systems through this place, Mount Royal Vale, Montreal Junction, Cote St., Pierre, and Rockford. The line is to be in operation by Aug. 1. A. J. Corriveau has been representing the company.

HIGHWAYS.

OHIO.—Press reports state that the authorities of Mahoning county at Youngstown are considering two projects to relieve the prevailing distress caused by lack of employment. One is to issue $200,000 worth of bonds and employ men to macadamize the roads. Another is the proposition of business men to sign notes upon which the banks will advance money until the taxes are collected, the money to be applied to road improvements.

BRIDGES.

ALBANY, N. Y.—Bids are asked until Dec. 20 for lift bridge superstructure over Erie Canal at Geddes St., Syracuse; iron swing bridge superstructure over Ohio Basin at Ohio St., Buffalo; masonry work and superstructure of wrought iron bridge over the Erie Canal at Griffith St., Rochester, and two spans of superstructure complete for bridge over the Tonawanda Creek, at Pickardsville. Edward Hannan, Supt. Pub. Wks.

BUFFALO, N. Y.—Bids are asked until Jan. 8 for plans for a bridge across the Erie Canal on the line of Porter Ave. Wm. McMillan, Supt. Park Dept.

SCRANTON, PA.—Joseph P. Phillips, Cy. Engr., writes us that the following bids were received Dec. 6 for the erection of superstructure of Linden St. bridge, (1) being the bid for plank flooring and (2) for asphalt floor on buckle plates:

	1.	2.
Toledo Bridge Co., Toledo, O.	$62,300	$83,430
Boston Bridge Co., Boston, Mass.	72,408	97,802
Columbus Bridge Co., Columbus, O.	77,033	99,300
Youngstown Br. Co., Youngstown, O.	68,000	92,000
Owego Bridge Co., Owego, N. Y.	66,000	84,900
Penn Bridge Co., Beaver Falls, Pa.	55,400	74,400
Union Bridge Co., Athens, Pa.	67,500	84,400
Massillon Bridge Co., Massillon, O.	62,150	84,513
Schiffler Bridge Co., Pittsburg, Pa.	59,900	80,500
King Bridge Co., Cleveland, O.	64,700	88,500
Nelson & Buchanan, Chambersburg, Pa.	83,000	112,700
Edge Moor Bridge Co., Wilmington Del.	54,200	*72,100
Groton Bridge Co., Groton, N. Y.	56,794	74,328
Rochester Bridge Co., Rochester, N.Y.	71,148	97,928
Horseheads Br. Co., Horseheads, N.Y.	61,975	82,350
New Jersey Steel & Iron Co., Trenton	65,200	88,700
Passaic Rolling Mill Co., Paterson, N.J.	71,619	79,579
Canton Bridge Co., Canton, O.	60,771	83,473
Variety Iron Wks. Co., Cleveland, O.	61,600	81,981
Wrought Iron Bridge Co., Canton O.	56,394	79,000
Chicago Bridge & Iron Co., Chicago.	56,800	79,500
Pottsville Bridge Co., Pottsville, Pa.	70,555	89,590
Phoenix Bridge Co., Phoenixville, Pa.	57,500	75,050
Pennsylvania Steel Co., Steelton, Pa.	58,700	79,700

* $72,100, $68,900 and $70,800.

TOWSON, MD.—The lowest bid for the building of a bridge to consist of an iron draw span and two fixed iron spans across Bear Creek, in the twelfth district, and also for the building of a wooden pile bridge in the place of the two fixed spans, was that of the Campbell-Zell Co., of Baltimore, at $13,700 for the bridge with the two fixed iron spans and $9,800 for the wooden pile bridge. There were 13 bids, the highest being $19,700 and $16,275, respectively.

AUGUSTA, GA.—Bids are asked until Dec. 15 for building an iron and steel bridge over the Third Level of the canal at Green St. C. H. Davidson, Cy. Engr.

NATCHEZ, MISS.—Bids are asked until Feb. 4 for the construction of a steel bridge, with approaches, over the Homochitto River, at Swayze's Ferry. Allison H. Foster, Chancery Clk., Adams county.

NEW ORLEANS, LA.—L. W. Brown, Cy. Engr., writes us that the following bids were received last month for swing bridges over the Carondelet Navigation Canal at Hagan Ave. and Roman St.; total length of bridge, 95 ft.; clear width of opening for passage of vessels, 50 ft.:

	Hagan Ave.	Roman St.
Gillette-Herzog	$7,500	$7,500
King Bridge Co.	6,500	6,500
Iron Substructure Co.	....	5,200
Milwaukee Bridge Co.	9,328	9,328
" " "	9,318	9,318
Brackett Bridge Co.	9,560	9,560
Variety Iron Works.	9,500	9,500
Toledo Bridge Co.	6,100	6,100
" " "	5,975	5,850
Penn Bridge Co.	5,900	....
George H. Tinker.	8,650	8,650
Youngstown Bridge Co.	6,500	6,500

KNOXVILLE, TENN.—Wm. C. Crozer, Knoxville, has been engaged by the county court of this county to make surveys and estimates for a highway bridge across the Tennessee River at this place. Three different sites have been surveyed. The bridge will be from 1,700 to 1,900 ft. long. The court will take action on the report at the January term.

CINCINNATI, O.—Bids are asked until Dec. 22 for a wrought iron Pratt truss bridge over Little Duck Creek

on Columbian Ave., Columbia township. Fred Bader, Pres. County Comrs.

MENOMINEE, MICH.—The citizens have voted to appropriate $15,000 for one-half of the cost of an iron bridge from this city to Mariette to replace an old wooden bridge.

CHICAGO, ILL.—The Chicago Dock Co. has awarded the contract for the construction of a viaduct in its yard at West Taylor St., to the American Bridge Works of Chicago, at $22,750. W. L. Stebbings, 1118 Monadnock Block, is the consulting engineer.

DAVENPORT, IA.—Local papers state that plans have been prepared by C. F. Loweth, St. Paul, and are now being examined by Maj. A. Mackenzie,, U. S. Engr. Office, Rock Island, Ill., for a new bridge across the Mississippi River at this place. The plans contemplate a bridge of 200-ft. spans, with a draw span 440 ft. in length, and is estimated to cost $400,000.

BROOKINGS, S. DAK.—Bids are asked until Dec. 27 for building a steel bridge 75 ft. long across the Sioux River. D. R. Sweezey, County Audr.

HOUSTON, TEX.—The following bids were recently received for constructing a bridge across Buffalo Bayou, at Factory St.:

Chicago Bridge Co., Chicago	$43,150
Groton Bridge Co., Groton, N. Y.	41,977
Missouri Valley Bridge Co., St. Louis, Mo.	44,800
Geo. E. King Bridge Co., Des Moines, Ia.	44,188
Toledo Bridge Co., Toledo, O.	39,600
Milwaukee Bridge Co., Milwaukee, Wis.	39,843
Wrought Iron Bridge Co., Canton, O.	42,500
Youngstown Bridge Co., Youngstown, O.	41,740
New Columbus Bridge Co., Columbus, O.	40,480
King Bridge Co., Agency, Houston,	42,826
B. A. Rissner, Houston	37,860

DENVER, COLO.—Bids are asked until Dec. 17 for the construction of a pile truss bridge across Clear Creek, between the counties of Jefferson and Arapahoe. The bridge will be about 126 ft. in length and 16 ft. wide, with three spans. Richard Le Bert, County Clk. and Recdr.——The board of public works has engaged Aulls & Hand, Denver, to make plans and specifications for a new bridge across Cherry Creek at Broadway. The bridge will probably be built if the Denver Consolidated Tramway Co., which would have two tracks over the bridge, will agree to pay its share of the cost.

YARMOUTH, N. S.—Bids are asked until Dec. 15 for rebuilding the Hewitt's bridge on the west side of Tusket River. Comfort Clements, Inspector.

HAMILTON, ONT.—It is reported that a new steel bridge will be built over the Burlington Canal in this city by the Dominion government. Mr. Coste, Ch. Engr., Dept. Pub. Wks., has nearly completed the plans, and bids for the work will probably be called for at an early date in order that the bridge can be built in time for next year's traffic.

WATER-WORKS.

HALLOWELL, ME.—Jas. A. Sheehan, Cy. Clk., writes us that the committee has recommended works to be owned by the city, and the mayor has been instructed to petition the legislature, which meets next month, for authority to take a supply from a lake seven miles from the city.

LYNDONVILLE, VT.—I. W. Sanborn, Clk., writes us that no action has yet been taken by the village on the matter of issuing $40,000 in bonds for works, recently authorized, as noted last week.

LYNN, MASS.—The council has authorized the construction of a water storage basin in the Hawkes Brook Valley at a cost of $125,000, according to local papers.

NEW BEDFORD, MASS.—The city received 17 bids for the $200,000 of water bonds, and sold them to Blodgett, Merritt & Co., Boston, for $218,632.

ROWAYTON, CONN.—The New York, New Haven & Hartford R. R. Co. is reported as completing arrangements for a pumping station for a water supply at this place, South Norwalk and Stamford from Chasmar's Pond.

MIDDLETOWN, N. Y.—J. J. R. Cross, New York, has submitted a report to the commissioners recommending a supply from Shawaugank Kill, at an estimated cost of $150,000.

MONTGOMERY, N. Y.—The trustees are reported as ready to receive proposals from any party that will put in works and enter into an agreement that is equitable to the residents of the village.

PAWLING, N. Y.—We are informed that the proposition to issue $30,000 in bonds for works was carried by a vote of 48 to 15.

TARRYTOWN, N. Y.—The commissioners are reported as about to apply for the condemnation of land at East Tarrytown for a new reservoir to cost $75,000 or more.

EGG HARBOR CITY, N. J.—V. P. Hofmann, Cy. Clk., writes us that the ordinance granting a franchise to the Egg Harbor City Water, Electric Light & Power Co. was passed on Dec. 8. The city is to pay $1,200 a year for 31 fire plugs and to have the right to purchase the plant or renew the contract after 10 years. The rates to private parties is fixed by ordinance; supply from driven or artesian wells. Engr., Col. W. W. Taylor, 208 Walnut Place, Philadelphia.

HIGHTSTOWN, N. J.—It is reported that the council is taking steps to secure an issue of $40,000 in bonds for works and other improvements.

NEWTON, N. J.—Contracts for materials have been awarded as follows: Warren Foundry & Machine Co., pipe; Eddy Valve Co., valves and hydrants; Tippett & Wood, standpipe; bids for wrought iron pipe rejected. Ch. Engr., Louis L. Tribus, 84 Warren St., New York.

NUTLEY, N, J.—The Nutley Water Co. is reported about to extend its service to all parts of the township.

SHORT HILL, N. J.—Stewart Hartshorn has commenced the construction of a large reservoir on his property in Springfield, according to reports, to secure water for domestic and power purposes in this place.

CANONSBURG, PA.—We are informed that an ordinance granting a franchise to Pittsburg parties will come up for final passage at the meeting of the council Jan. 8. For information address F. H. Tooker, Times Bldg., Pittsburg.

CORRY, PA.—Bids are asked until Feb. 1 for constructing works; also for furnishing a supply for fire protection. Works were built here in 1886 by the Corry Water Co. Col. T. A. Edwards.

HARRISBURG, PA.—The question of new water supply is again being agitated by the citizens.

ROCKWOOD, PA.—The citizens are reported as discussing the question of works.

SHARON, PA.—Malin Ewing, Borough Secy., writes us that the council is negotiating with the Sharon Water-Works Co. for a new contract and that if they fail to agree upon a price the borough will no doubt take steps to secure municipal works, as the citizens seem to be educated in that direction.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Dec. 17 for a supply of cast iron water pipe, as stated in our advertising columns (postponement of date from Dec. 10).

BRAMWELL, W. VA.—The Bramwell Water Co. has been incorporated with a capital stock of $50,000, of which $3,200 is paid in, to supply water and ice; incorporators, J. D. Stewart, Jenkin Jones, Harry Bowen, B. Moore, J. T. Mann and others, of this city.

KEY WEST, FLA.—The city commissioners have voted to annul the contract for works which was awarded some time ago to D. Lamar and it is reported that the contract has been let to the Virginia Paving & Construction Co.

COLUMBUS, GA.—M. M. Moore, Clk. Cy. Council, writes us that the proposition to issue $350,000 in bonds for new works failed to secure the required two-thirds majority at the election Dec. 8.——The Columbus Water-Works Co. is reported as contemplating important extensions and improvements. Pres., H. H. Epping.

COVINGTON, KY.—The Central Covington council has been authorized to issue bonds to secure an extension of the works to that place, according to reports.

HOPKINSVILLE, KY.—Jesse W. Starr, New York, submitted a proposition to the council last week, in which he offered to put in 10 miles of piping and furnish the city 100 fire hydrants for $3,000 a year, construction to be commenced within 60 days.——The Hopkinsville Water, Light & Power Co. is receiving subscriptions for additional stock for the purpose of putting in water-works in connection with its electric plant, and is reported as soon to make a proposition to the council.

CADIZ, O.—The city has sold $35,000 in water bonds for $35,692, according to reports.

LOWELLVILLE, O.—There is talk of constructing works to be owned by the city, according to reports.

SPRINGFIELD, O.—The city has sold $50,000 of water bonds for $59,950.

TOLEDO, O.—The estimated cost of a 30 or 36-in. main through the western portion of the city is about $75,000.

CHICAGO, ILL.—Bids are asked until Dec. 21 for repairs to three boilers at Harrison St. pumping station. John McCarthy, Comr. Pub. Wks.

BRIGHTWOOD, IND.—William Wright, Secy. Com., writes us that the specifications for works will be ready for distribution by Dec. 25, and that bids will be received about Jan. 15. Chas. Meadows, Chn. Com.

MADISON, IND.—The council has voted to engage an engineer to make plans for a new 2,000,000-gallon pumping engine for which it is reported that bids will soon be asked.

NEW ALBANY, IND.—The first charter of the water company expires next year, and the council is reported as taking steps to purchase the works.

CENTERVILLE, MICH.—We are informed that the water-works proposition was defeated Dec. 4 by a vote of 83 to 84.

DECATUR, MICH.—Plans and specifications for the proposed works are being prepared by W. S. Shields, Title & Trust Bldg., Chicago. Water will be pumped to a stand-pipe.——Frank C. Stapleton, Clk., writes us that the $12,000 of bonds have been sold and that bids for the construction will be opened about Jan. 10, specifications to be ready about Dec. 26.

BERRIEN SPRINGS, MICH.—The Berrien Springs Water Power Co. has been incorporated to construct a dam in the St. Joseph River and to furnish water for domestic and power purposes; capital stock, $50,000; directors, Geo. H. Murdock, R. D. Dix, Fred McOmber, A. B. Ayer and others.

CHESTER, ILL.—The question of works is again being discussed, according to reports.

CISSNA PARK, ILL.—It is reported that this place will soon have works.

OSWEGO, ILL.—The contract for a tower and tank, etc., has been awarded to the Chicago Bridge & Iron Wks., at $3,000. I. Newcomber & Co., Chicago, bid $3,598, and the U. S. Wind Engine & Pump Co., Batavia, $3,588. Engr., Jason F. Richardson, Jr., Ottawa, Ill.

MOUNT STERLING, ILL.—The Mount Sterling Water Co. has been incorporated by B. C. Washburn, W. S. Cory, B. T. Ross and J. L. Gray.

VIRGINIA, ILL.—Jno. A. Jones, Chn. Com., writes us that Mr. Dudley, of St. Louis, is preparing plans which will probably be submitted to the council next week. No appropriation has yet been made for the construction.

KAUKAUNA, WIS.—The Kaukauna Water-Works Co. is reported to have failed to begin work within the limit of time agreed upon and to have forfeited a $500 bond because of the failure.

RUSHFORD, MINN.—F. A. Olson, Cy. Clk., writes us that the city has laid about 10,000 ft. of pipe, built a stone reservoir at an elevation of 155 ft. and proposes to pump a water supply from an 8-in. well 295 ft. deep, the works to cost about $13,500.

WATERVILLE, MINN.—A. W. Knaak, Village Recdr., writes us that no election has yet been held to vote on the question of works; supply will probably be from a well; population, 2,000.

WEST DULUTH, MINN.—Maurice Auerbach has been appointed receiver of the West Duluth Light & Water Co.

BLOOMFIELD, NEB.—It is reported that bonds will be issued for works.

CHILLICOTHE, MO.—The plant of the Chillicothe Water & Light Co. was sold by the sheriff Dec. 6 to G. W. Meyers, Kansas City, at $25,000, representing T. C. Woodbury, Portland, Me.; N. E. Eeb., A. G. Black and Hiram Steel, of New York, and W. G. Pinecoffin, of London.

JONESBORO, ARK.—It is reported that works will be put in by New York parties.

PRESCOTT, ARK.—Works will be put in at this place, according to reports.

HILLSBORO, TEX.—The attorney-general has approved the ordinance recently passed to issue $20,000 in bonds for works.

TRINITY, TEX.—We are informed that contracts have all been awarded and the construction of works commenced.

PERRY, OKLA.—L. M. Howe, of the Howe Pump & Engine Co., Indianapolis, is reported as in the city to petition for a franchise for works and an electric light plant.

CRIPPLE CREEK, COLO.—The Cripple Creek Water Co. was incorporated Dec. 6; capital stock, $100,000; incorporators, Eugene H. Smith, Victor; S. V. Salen and Henry Diedrich, Bay City, Mich.

DELTA, COLO.—The Montrose & Delta County Water Co. was incorporated Dec. 7 to put in works, supply from Gunnison River; capital stock, $100,000; incorporators, Francois C. Larzon, H. O. eBar, and G. O. Frost, all of Delta.

ASTORIA ORE.—Bids are asked until Jan. 10 for constructing complete works, estimated to cost about $225,000. The work will be advertised in our issue of next week. H. G. Vandusen, Clk. Comrs.

ASTORIA, ORE.—Jas. D. Schuyler, Consult. Engr., has submitted a report approving the plans of Adams & Gemmell for new works, as described in our issue of Oct. 25. Mr. Schuyler states that the new works are an imperative necessity; total estimated cost, $230,856, including an electric light plant.

SAN DIEGO, CAL.—The bids for an 8,000,000 gallon reservoir at La Mesa ranged from $25,000 to $39,000, according to press reports, the bidders being Carl & Abernathy, Stockton; Stone & McMurphy and C. J. Scovie (reported the lowest), San Francisco; Waide & Capron, San Diego; Grant Bros., Los Angeles; Jos. Nickerson, San Diego.——A later report states that the San Diego Flume Co. will probably reject all the bids and do the work itself.

SANTA CLARA, CAL.—This town has voted to issue bonds for municipal works. C. E. Moore, Engr., may be addressed for particulars.

CHATHAM, ONT.—The proposition to issue bonds to purchase the works, as noted in our issue of Nov. 22, was defeated Dec. 5 by 490 majority. John Tissiman, Town Clk.

DIGBY, N. S.—The council has been unanimously authorized to issue $35,000 in bonds for a gravity system of works, and the construction will probably be commenced early in the spring. Engr., J. A. Pickett.

ARTESIAN WELLS.

FARGO, N. DAK.—J. B. Power, Pres. North Dakota Agricultural College, writes us that none of the bids made for sinking an artesian well for subexperiment station to that institution at Edgeley were in accord with the requirements of the board and contracts were not let. Nothing will now be done until after further legislation.

IRRIGATION.

LOUP CITY, NEB.—Press reports state that the Sherman County Irrigation, Water Power & Improvement Co., which was incorporated in August, is now actively employed in excavating and constructing its canal, extending from Arcadia to Rockville, in the Middle Loup valley, a distance of over 26 miles. Over 100 teams are now at work, and it is expected that 160 men will be working in a few days. The company expects to have the ditch completed to Loup City by Jan. 1.

KLAMATH FALLS, ORE.—Jesse D. Carr & Son, Klamath county, will next year construct a reservoir, capable of holding 39,000,000 gallons of water, to be used in irrigating alfalfa lands, according to reports.

NEW COMPANIES.—Manadas Irrigation Co., Laredo, Tex.; $10,000; J. S. Taylor, C. A. Higby.

Louis. Mires Irrigation Co., Christobal, Tex.; $10,000; L. H. Mires, Mark Fury.

Syracuse Irrigating Ditch Co., Syracuse, Kan.; $20,000; L. P. Worden, P. P. Thomas.

Hubbs & Miner Ditch Co., Porterville, Cal.; $5,280; J. L. Miner, Porterville; T. N. Jarrard, Lindsay; C. W. Harper, Woodville.

Entiat Improvement Co., Waterville, Ore.; $8,000; to construct and operate irrigating ditches; Frank Ford, A. E. Case, A. L. Rogers.

Riverside Ditch Co., Hanford, Cal.; $10,000; Timothy Paige, San Francisco; J. D. Hyde, Visalia; John McAdam, Hanford; P. C. Phillips, Lillis.

Woodbury Water Co., Allerton, N. Mex.; $10,000; irrigation, mining, manufacturing purposes and construction of reservoirs in Cochiti, Pino and Medio Dia Canons; W. P. Phillips, J. W. Bailey, R. T. Woodbury.

SEWERS.

FARMINGTON, ME.—Geo. W. Wheeler, Chn. Com., writes us that at a corporation meeting held Dec. 3 it was voted to engage Prof. Geo. C. Purington, of the state normal school, to make surveys for a system. The committee has recommended that a system to cost about $10,000 be constructed. G. W. Titcomb, Village Clk.

NEW LONDON, CONN.—The engineer has prepared a plan for a system in the portion of the city known as Winthrop's Neck.

BROOKLYN, N. Y.—Bids are asked until Dec. 21 for constructing a sewer in Sixth Ave. A. T. White, Comr. Cy. Wks.

ROCHESTER, N. Y.—The East Side trunk sewer commission received nine bids for the construction

of the proposed storm overflow sewer, the lowest being Lauer & Hagaman, at $22,996; engineer's estimate, $50,000.

HIGHTSTOWN, N. J.—There is talk of issuing bonds for a system.

JERSEY CITY, N. J.—Bids are asked until Dec. 24 for constructing 660 ft. of 24-in. pipe and 540 ft. of 24-in. oval brick sewer in two streets, the work including 450 cu. yds. of rock excavation. G. T. Bouton, Clk. St. Comrs.

SHARON, PA.—Malin Ewing, Borough Secy., writes us that plans and specifications for a complete system have been prepared by Potter & Folwell, Pittsburg, but that it is not expected that any work will be done before next spring; estimated cost, $90,000.

WILLIAMSPORT, PA.—It is proposed to build sewers next year in several portions of the city as recommended by the city engineer, and which are estimated to cost $98,457.

TROY, ALA.—Authority has been asked to issue $30,000 in bonds for sewers and streets.

COVINGTON, KY.—The engineer has been directed to make an estimate of the cost for a branch sewer to connect with the Willow Run sewer to drain a portion of Lewisburg, estimated to cost $5,000.

ASHTABULA, O.—H. Starkweather has been awarded the contract for constructing sewers in six streets at $8,748, the other bidders being M. H. McCourt, Toledo Construction Co., S. H. & C. R. De Groodt and McKenzie & Pullman.

CHILLICOTHE, O.—There is talk of forming a company with a capital stock of $100,000 to construct a sewerage system which is estimated to cost about $100,000.

COLUMBUS, O.—Bids are asked until Dec. 18 for constructing a 12-in. pipe sewer. J. A. Fanning, Clk. Bd. Pub. Wks.

IRONTON, O.—The council has adopted resoiutions for constructing 15 and 12-in. pipe sewers in several streets. G. H. Davies, Cy. Clk.

TOLEDO, O.—Bids are asked until Dec. 17 for constructing a 24-in. cylindrical brick sewer in Warren St. L. F. Harris, Cy. Clk.

NEW ALBANY, IND.—It is reported that a committee has been appointed by the Commercial Club to make arrangements for surveying the city for a system.

PEORIA, ILL.—The council has passed an ordinance for constructing the West Bluff system. The work will include 32 miles of pipe and brick sewers, and is estimated to cost $375,000. It is hoped to commence the construction early in the spring.

LA CROSSE, WIS.—The city engineer is preparing plans for sewers to drain the portion of the city bounded by St. James, Rublee and George Sts. and the Black River.

TWO RIVERS, WIS.—W. S. Shields, Title & Trust Bldg., Chicago, is preparing plans for a system.

DES MOINES, IA.—Bids are asked by the department of public works until Dec. 20 for constructing a system for the portion of the city known as the Town of Desmoine.

ST. LOUIS, MO.—The board of public improvements has passed ordinances for constructing sewers in two streets, estimated to cost $18,100.

AUSTIN, TEX.—J. T. Smith, Engr., writes us that 6,000 ft. of 8-in. pipe sewers are to be constructed, estimated to cost $3,500. This is a completion of a part of the general system which was built last winter.

STREETS.

SYRACUSE, N. Y.—The Rock Asphalt Paving Co. has been awarded the contract for paving Montgomery St., at $18,953. The other bids were: Syracuse Improvement Co., $21,862; Bermudez Paving Co., $21,914, and the Warren-Scharff Asphalt Paving Co., $22,738.

JERSEY CITY, N. J.—Bids are asked until Dec. 24 for about 2,170 sq. yds. of stone paving, etc. G. T Routon, Clk. St. Comrs.

LIMA, O.—Bids are asked until Dec. 21 for 12,635 sq. yds. of brick paving. C. E. Lynch, Cy. Clk.

TOLEDO, O.—The council has voted to pave Central Ave.

WINNIPEG, MAN.—H. N. Ruttan, Cy. Engr., wants to correspond with manufacturers for prices of brick or asphalt for the proposed paving of Main St.

ELECTRIC LIGHT AND POWER.

CHICOPEE, MASS.—The citizens voted on Dec. 4 in favor of a municipal electric light plant.

DALTON, MASS.—Homer Bicknell, Town Clk., writes us that there is talk of putting in an electric light plant, but that no steps have yet been taken.

FISKDALE, MASS.—It is reported that there is talk of forming a company to light this town, Brimfield and Holland by electricity.

NORWICH, CONN.—Steps are being taken to secure a city gas and electric light plant, according to reports.

BROOKLYN, N. Y.—The Municipal Gas & Electric Co., with a capital stock of $100,000, has applied for a franchise. Pres., A. W. Wanamaker, Jersey City; B. I. H. Trask, New York, and Charles Hauck, Philadelphia, are two of the directors.

EGG HARBOR CITY, N. J.—V. P. Hoffmann, Cy. Clk., writes us that an ordinance was passed Dec. 8 granting a franchise to the Egg Harbor City Water, Electric Light & Power Co. of New Jersey, and contracting for 20 arc lights of 1,500 c. p. at $50 per light per year; work to be commenced in two months after publication of ordinance and to be completed within a year. Engr., Col. W. W. Taylor, 208 Walnut Place, Philadelphia.

HIGHTSTOWN, N. J.—The council has ordered a petition circulated for the purpose of bonding the town for $40,000 for an electric light plant, waterworks and sewers, which it is hoped to put in next year.

IRVINGTON, N. J.—It is reported that the question of forming an electric light and power company for putting in a plant for this village and Clinton township is being discussed. The village and township are now paying over $300 per month for electric lights of 16 c. p. It is probable a meeting will soon be called for the purpose of organizing the company.

CORRY, PA.—Bids are asked until Feb. 1 for lighting the streets with arc lamps. Address Col. T. A. Edwards.

ERIE, PA.—Bids are asked until Dec. 20 for lighting the streets and public buildings by electricity or gas for one year. T. Hanlon, Cy. Clk.

ROTHSVILLE, PA.—A number of subscribers have been secured for the proposed electric light plant. A meeting to discuss the subject will soon be held, according to reports.

GADSDEN, ALA.—Press reports state that the Queen City Electric Co. will double the capacity of its plant.

OWENSBORO, KY.—Bids are asked by W. P. Small for constructing an electric light plant, according to reports.

CLEVELAND, O.—The county commissioners are reported as asking for bids for putting an electric plant into the county buildings. The commissioners are discussing whether to put in a plant or have the local electric light company do the lighting.

HARTWELL, O.—The New York Standard Construction Co. has applied for a franchise for an electric light plant and electric railway.

NORWOOD, O.—Col. J. M. Harper has been directed by the council to prepare estimate of the cost of an electric light plant.

WAUSEON, O.—Press reports state that H. H. Williams & Co. are preparing to enlarge their brick dynamo building, at the same time build a new boiler and engine house. New dynamos will be added.

CISSNA PARK, ILL.—It is reported that an electric light plant and telephone system will be put in.

LOGAN, IA.—The committee appointed to prepare plans for water-works system has recommended that an electric light plant be added to the system.

MONTGOMERY CITY, MO.—It is reported that this place is soon to have an electric light plant.

SALT LAKE CITY, UTAH.—The committee on improvements is discussing a scheme to erect a municipal electric light plant, which is estimated to cost about $50,000.

ST. BONIFACE, MAN.—A new electric light company is being organized and will soon apply for a charter to furnish electricty in any part of Manitoba. It is reported that the material for the plant will soon arrive.

NEW COMPANIES.—Nutting Electric Co., Chicago, Ill.; $50,000; James W. Hedenberg, F. A. Smith.

Porter Air-Lighter Co., Portland, Me.; $500,000; Pres., E. K. Milliken, Cumberland; Treas., C. A. Height, Portland.

Avalon Electric Light Co., Avalon, Pa.; $500; Treas., E. G. Caughey, Allegheny.

Bellevue Electric Light Co., Bellevue, Pa.; $500; Treas., E. G. Caughey, Allegheny.

Winamac Electric Light & Power Co., Winamac, Ind.; $10,000; J. H. Weaver, I. V. Smith.

Ginett & Yettman Co., Chicago, Ill.; $20,000; L. D. Thoman, F. W. Harwell, W. S. Holden.

Springfield Electric Equipment Co., Springfield, Mass.; W. F. Evans and H. W. Wright.

Paducah Electric Co., Paducah, Ky.; $40,000; Elbridge Palmer, R. Rowland, J. L. Friedman.

White Hall Electric Co., White Hall, Ill.; $10,000; G. S. Vasseller, O. F. Griswold, H. W. Hand.

Raton Electric Light & Power Co., Raton, N. Mex.; $20,000; Frederick Brueggemann, T. A. Schomburg.

Prescott Electric Co., Prescott, Ont.; $250,000; J. W. McRae, Thomas Ahearn, Lenox Blackburn, Ottawa.

Ben Avon Electric Light Co., Ben Avon, Pa.; $500; Treas., E. G. Caughey, 264 Allegheny Ave., Allegheny.

Chatham Electric Light & Power Co., Savannah, Ga.; George Parsons, J. H. Johnston, J. N. Harriman.

Plainville Electric Light & Power Co., Hartford, Conn.; C. S. Landers, W. H. Brayton, M. B. Hitchcock.

Electric Storage Battery Co., Philadelphia, Pa.; capital stock increased from $10,000,000 to $13,500,000; Pres., W. W. Gibbs.

GARBAGE DISPOSAL.

ALBANY, N. Y.—The garbage committee of the board of health is reported as soon to hold a meeting to consider the question of selecting a garbage crematory for use in this city. The subject has been under discussion for some time.

ATLANTIC CITY, N. J.—Ground was broken Dec. 6 for an addition to the garbage incinerating plant. The new furnace will have a capacity of 150 tons of garbage a day, making a total of 250 tons, according to reports.

MINNEAPOLIS, MINN.—At the last meeting of the board of trade Prof. Maria L. Sanford, of the university, read a paper on the need of better sewage and garbage-removal facilities. Prof. W. Folwell spoke briefly on the same subject and will read a paper on the garbage question at a later meeting.

LITTLE ROCK, ARK.—It is reported that bids are asked by the bord of public affairs for the erection of a garbage crematory. H. C. Jones, Cy. Clk.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

FIRE HOSE AND HOSE CART.—Angola, Ind.—The town will soon purchase fire hose and a hose cart. Chas. V. Foulk, Clk.

ROAD ROLLER.—New York, N. Y.—Bids are asked until Dec. 18 for a steam road roller. Jas. M. Moore, D. Q. General, U. S. A., Army Bldg.

JAIL.—Beaumont, Tex.—Bids are asked until Feb. 11 for the construction of a brick jail, with steel cells, cost not to exceed $12,000. E. P. Gray, County Judge.

BREAKWATER.—San Francisco, Cal.—Bids are asked until Jan. 4 for building a breakwater at San Luis Obispo Harbor. Lieut.-Col. W. H. H. Benyaurd, U. S. Engr. Office.

PINE TIMBER.—St. Louis, Mo.—Bids are asked until Jan. 5 for furnishing and delivering longleaf yellow pine at Bonnot's Mill, Mo. Lieut.-Col. Chas. R. Suter, U. S. Engr. Office.

PLANS FOR CITY HALL.—Cohoes, N. Y.—Architects are invited to submit plans until Jan. 7 for a city hall, station house and jail, the cost not to exceed $65,000. R. S. Clark, Clk. Comn.

STATION.—Wheeling, W. Va.—Bids are asked until Dec. 22 for building a new passenger station in this city. Address M. J. Becker, Ch. Engr., P., C., C. & St. L. Ry., Pittsburg, Pa.

STONE DAM.—Holyoke, Mass.—Bids are asked until Feb. 15 for constructing a stone dam in the Connecticut River, as stated in our advertising columns. Holyoke Water Power Co.

PARK SYSTEM.—Indianapolis, Ind.—The plans of Earnshaw & Punshow for a park system for this city were further considered at a meeting of the joint committee at the Commercial Club rooms Dec. 5.

DRAINAGE COMPANY.—Mamaroneck, N. Y.—The Mamaroneck Drainage Co. was incorporated Dec. 7; capital stock, $10,000; directors, C. F. Judson, A. B. Duffie, Wm. F. Judson, and J. S. Tracy, of New York.

ELEVATORS.—New York, N. Y.—Bids are asked until Dec. 27 for two passenger elevators in the U. S. custom house in this city. Address Chas. E. Kemper, Acting Supervising Arch., Treasury Dept., Washington, D. C.

CANAL IMPROVEMENTS.—Albany, N. Y.—Bids are asked until Dec. 20 for several contracts for improving the state canals. Edward Hannan, Supt. Pub. Wks.

STEAM FIRE ENGINES, ETC.—Philadelphia, Pa.—Bids are asked until Dec. 21 for one or more steam engines with pumps to discharge 700 gallons of water per minute, one or more steam fire engines, hose cart and chemical engines, water towers, hose, etc. A. M. Beitler, Dir. Dept. Public Safety.

CITY HALL.—Quebec, Que.—The following contracts have been awarded for the construction of the new city hall: Excavation and masonry, J. B. Jinchereau, $71,316; carpenter and joiner work, J. B. Gingras, $27,996; plumbing and gas fitting, Paul Parent, $1,775; heating apparatus, Ovide Picard, $7,400; roofing, N. K. Connolly, $5,400; painting and glazing, Jos. Gauthier & Frere, $2,755; total, $116,612.

BUILDINGS.—Atlanta, Ga.—Bids are asked until Jan. 2 for the construction of the U. S. government building to be erected on the Exposition grounds, as stated in our advertising columns. Address Chas. E. Kemper, Acting Supervising Architect, Washington, D. C.

Medford, Wis.—Bids are asked until Jan. 12 for the erection of a hotel building. Arch., W. A. Holbrook, Milwaukee. Fayette Shaw, Chn. Bldg. Com.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Dec. 14.	Tunnel,	Cleveland, O.	Nov. 22
Dec. 15.	Surveying,	Flemington, N. J.	Nov. 22
	Advertised, Eng. News, Nov. 22.		
Dec. 15.	Iron tanks for sale,	Burlington, N. J.	Dec. 6
	Advertised, Eng. News, Dec. 6 and 13.		
Dec. 15.	Bridge,	Yarmouth, N. S.	Dec. 13
Dec. 15.	Bridge,	Augusta, Ga.	Dec. 13
Dec. 17.	Wooden bridge,	Franklin, Neb.	Nov. 8
Dec. 17.	Lumber and stone,	Sioux City, Ia.	Nov. 29
Dec. 17.	Water bonds	Fort Collins, Colo.	Nov. 29
Dec. 17.	Paving,	Houston, Tex.	Dec. 6
Dec. 17.	Cast iron pipe,	Washington, D. C.	Dec. 13
	Advertised, Eng. News, Nov. 29 and Dec. 13.		
Dec. 17.	Brick sewer,	Toledo, O.	Dec. 13
Dec. 17.	Bridge,	Denver, Colo.	Dec. 13
Dec. 18.	Telephone system,	Washington, D. C.	Nov. 22
Dec. 18.	Arteslan well near	San Marcos, Tex.	Nov. 29
	Advertised, Eng. News, Nov. 29 to Dec. 13.		
Dec. 18.	Constructing water-wks.,	Newton, N. J.	Nov. 8
	Advertised, Eng. News, Nov. 8 and 15.		
Dec. 18.	Pipe sewers,	Buffalo, N. Y.	Dec. 6
Dec. 18.	Brick wall,	Roanoke, Va.	Dec. 6
Dec. 18.	Buildings,	Atlanta, Ga.	Dec. 6
Dec. 18.	Water bonds ($100,000),	Portland, Ore.	Dec. 6
Dec. 18.	Timber,	Montreal, Que.	Dec. 6
Dec. 18.	Monuments,	Ottawa, Ont.	Dec. 6
Dec. 18.	Steam road roller,	New York, N. Y.	Dec. 13
Dec. 18.	Pipe sewer,	Columbus, O.	Dec. 13
Dec. 20.	Brick sewers,	San Antonio, Tex.	Nov. 22
	Advertised, Eng. News, Nov. 22 to Dec. 13.		
Dec. 20.	Pipe sewers,	San Antonio, Tex.	Nov. 22
	Advertised, Eng. News, Nov. 22 to Dec. 13.		
Dec. 20.	Sewer pipe, brick, etc.,	San Antonio, Tex.	Nov. 22
	Advertised, Eng. News, Nov. 22 to Dec. 13.		
Dec. 20.	Pipe sewers (26,185 ft.),	Pittston, Pa.	Nov. 29
	Advertised, Eng. News, Nov. 29 to Dec. 13.		
Dec. 20.	Elevator at	Duluth, Minn.	Nov. 29
Dec. 20.	Brick sewers (3,720 ft.),	Pittston, Pa.	Nov. 29
	Advertised, Eng. News, Nov. 29 to Dec. 13.		
Dec. 20.	Pipe, 40-in.,	Cambridge, Mass.	Dec. 6
	Advertised, Eng. News, Dec. 6 and 13.		
Dec. 20.	Steam engines,	Washington, D. C.	Dec. 6
Dec. 20.	Water bonds	New Paynesville, Minn.	Dec. 6
Dec. 20.	Pipe, 30-in. (15,000 ft.),	Dallas, Tex.	Dec. 6
Dec. 20.	Street lighting,	Erie, Pa.	Dec. 13
Dec. 20.	Bridge at	Buffalo, N. Y.	Dec. 13
Dec. 20.	Canal work,	Albany, N. Y.	Dec. 13
Dec. 20.	Bridge at	Rochester, N. Y.	Dec. 13
Dec. 20.	Sewers,	Des Moines, Ia.	Dec. 13
Dec. 20.	Bridge at	Syracuse, N. Y.	Dec. 13
Dec. 20.	Bridge at	Pickardsville, N. Y.	Dec. 13
Dec. 21.	Dredging,	St. Augustine, Fla.	Nov. 29
	Advertised, Eng. News, Nov. 22 to Dec. 13.		
Dec. 21.	Sewer,	Brooklyn, N. Y.	Dec. 13
Dec. 21.	Fire Engines, etc.,	Philadelphia, Pa.	Dec. 13
Dec. 21.	Repairing boilers,	Chicago, Ill.	Dec. 13
Dec. 21.	Brick paving,	Lima, O.	Dec. 13
Dec. 22.	Drainage ditch,	Orland, Ill.	Dec. 6
Dec. 22.	Passenger station at	Wheeling, W. Va.	Dec. 13
Dec. 22.	Bridge,	Cincinnati, O.	Dec. 13
Dec. 24.	Street imp'v't bonds,	Madisonville, O.	Nov. 29
Dec. 24.	Concrete wall, etc.,	Brooklyn navy yard,	Nov. 29
Dec. 24.	Garbage cremat'y at	Brooklyn navy yd.	Dec. 6
Dec. 24.	Bridge superstructure,	Cincinnati, O.	Dec. 6
Dec. 24.	Stone paving,	Jersey City, N. J.	Dec. 13
Dec. 24.	Sewers,	Jersey City, N. J.	Dec. 13
Dec. 26.	Electric lighting,	Monroe, Mich.	Nov. 15
Dec. 27.	Borings,	Buffalo, N. Y.	Dec. 6
Dec. 27.	Sewer,	Washington, D. C.	Dec. 6
	Advertised, Eng. News, Dec. 6 to 20.		
Dec. 27.	Elevators,	New York, N. Y.	Dec. 13
	Advertised, Eng. News, Dec. 13 and 20.		
Dec. 27.	Bridge,	Brookings, S. Dak.	Dec. 13
Dec. 28.	Dredging,	Rock Island, Ill.	Dec. 6
	Advertised, Eng. News, Dec. 6 to 27.		

Dec. 28.	Stone and br'k w'k at Kansas City, Mo. Advertised, Eng. News, Dec. 6 and 13.	Dec.	6
Dec. 29.	Sewer system, Fortress Monroe, Va. Advertised, Eng. News, Dec. 6 to 27.	Dec.	6
Dec 31.	Hire of Dredging plant, Buffalo, N. Y. Advertised, Eng. News, Nov. 29 to Dec. 20.	Dec.	6
Jan. 2.	U. S. building at Atlanta, Ga.	Dec.	13
	Advertised, Eng. News, Dec. 13 and 20.		
Jan. 4.	Breakwater, San Francisco, Cal.	Dec.	13
Jan. 5.	Pine timber, St. Louis, Mo.	Dec.	13
Jan. 7.	Cement, stone, etc., Wilmington, N. C. Advertised, Eng. News, Dec. 6 to 27.	Dec.	6
Jan. 7.	Water bonds, Detroit, Mich.	Nov.	15
Jan. 7.	Plans for city hall, Cohoes, N. Y.	Dec.	13
Jan. 8.	Bridge plans, Buffalo, N. Y.	Dec.	13
Jan. 10.	Water-works system, Astoria, Ore.	Dec.	13
Jan. 12.	Hotel building, Medford, Wis.	Dec.	13
Jan. 23.	Electric light franchise, Winnipeg, Man.	Dec.	6
Jan. 23.	Gas franchise, Winnipeg, Man.	Dec.	6
Feb. 1.	Electric lighting, Corry, Pa.	Dec.	13
Feb. 1.	Water supply Corry, Pa.	Dec.	13
Feb. 4.	Bridge, Natchez, Miss.	Dec.	13
Feb. 11.	Jail, Beaumont, Tex.	Dec.	13
Feb. 15.	Stone dam, Holyoke, Mass.	Dec.	13
	Advertised, Eng. News, Dec. 13 to Jan. 24.		
Feb. 19.	Torpedo boats, Washington, D. C.	Dec.	6
No date.	Railway work, Middletown, Conn.	Dec.	13
	Advertised, Eng. News, Dec. 13 and 20.		
"	" .Garbage crematory, Little Rock, Ark.	Dec.	13
"	" .Electric light plant Owensboro, Ky.	Dec.	13

CONTRACT PRICES.

DREDGING.—Galveston, Tex.—Maj. A. M. Miller, U.S. Engr. Office, writes us that the following bids were received Nov. 27: For dredging 15,000 cu. yds. in West Galveston Bay, Chas. Clarke & Co., Galveston, 60 cts. per cu. yd. (awarded contract); Branch, T. Masterson, Galveston, 60 cts.; dredging, 150,000 cu. yds., in ship channel, Galveston Bay, Chas. Clarke & Co., 12½ cts. (awarded contract); Rittenhouse-Moore Dredging Co., Mobile, Ala., 13 cts.; for work in Buffalo Bayou, Tex., (1) being for dredging 30,000 cu. yds.; (2) removing 1,500 cu. ft. of logs; (3) felling 15,000 cu. ft. trees; (4) removing wrecks and stumps, per hour; (5) total:

	1.	2.	3.	4.	5.
Chas. F. Walker, Houston.	$.40	$.08	$.065	$15.00	$13,095
*Rittenhouse-Moore Co.	.30	.06	.05	13.50	9,840
Henry Camors, New Orleans	.38	.06	.07	12.00	12,540

* Awarded contract.

DRAINAGE.—Wheatfield, N. Y.—C. Wichterman, Supt., writes us that the following bids were received Nov. 28 for repairing the ditches for draining the low lands of this town: T. H. Ryan, bailing and draining, $300; grubbing and clearing, $500; earth excavation, 28,375 cu. yds., at 22 cts.; rock excavation, 10 cu. yds., at 50 cts.; estimated total, $7,047; W. R. Haven, lump bid, $7,180; Ensign & Wandel, lump bid, $7,759; William Babcock, lump bid, $8,496; J. Z. Roberts, earth excavation, 17 cts.; grubbing and clearing, 68 cts. per sq. yd.; Wurl & Kramer, rock excavation, $1.50; total bid, $6,040; J. E. Riorden (awarded contract), grubbing and cleaning, $275; drainage and bailing, $125; earth excavation, 19½ cts.; rock excavation, $1.50; total, $5,942.

PIPE.—New Bedford, Mass.—The contract for 558 gross tons of 12 to 24-in. cast iron pipe, with the option of adding 165 gross tons of 12 to 8-in. pipe, at the same price, has been awarded to R. D. Wood & Co., at $19.65 per gross ton. The Warren Foundry & Machine Co. bid $20.90, and the McNeal Pipe & Foundry Co., $20.50.

DAYS, were as follows, the price being for brick delivered f. o. b. cars in this city:

Coaldale Brick & Tile Co., Coaldale, Ala.	$1.15
Chas. Spinks & Co., Newport, Ky.	1.34
Bisbee & Foster, Jacksonville, Fla.	1.24¾
B. Wallis & Co., Baltimore, Md.	1.20
W. B. Harris & Co., Zanesville, O.	1.32
B. E. Melick, Tyron, Pa. (W. L. Jones, agent)	1.27

The Mack Engineering Co., Pittsburg, Pa., offered to furnish square vitrified paving blocks at $31 per 1,000 blocks, or round cornered Mack paving blocks at $32 per 1,000 blocks, or at $1.36 per sq. yd. It takes 43 of these blocks to pave a square yard, while it takes 60 ordinary paving brick.

WELLS.—Brightwood, Ind.—The contract for experimental wells for the water supply has been awarded to Chas. Krauss, at $5.50 per ft. for an 8-in. well 105 ft. deep and $4 for each additional foot. Henry Peterman bid $6 and $4.50, respectively. Wm. Wright, Secy. Com., writes us that the boring of the well will be commenced this week.

INSPECTION OF BRIDGE WORK.—Denver, Colo.—The contract for inspecting the material for the 38th bridge has been awarded to the Osborn Co., Cleveland, at 85 cts. a ton, the cost to be paid by the contractors, according to press reports. The contract for this bridge was awarded to the Youngstown Bridge Co., and the bids were published in our issue of Nov. 29.

SEWERS AND BRICK PAVING.—East St. Louis, Ill., —The lowest bid for improving Eighth St. was that of Francis McCable, Union Trust Bldg., St. Louis, as recently stated in these columns. The prices are reported as follows: Excavating trenches and refilling, 22 cts. per cu. yd.; 30-in. sewer pipe, laid complete, $1.85 per lin. ft.; 24-in., 95 cts.; 18-in., 50 cts.; 10-in., 19 cts.; 6-in., 11 cts.; brick work in cesspolls, $14 per M. brick; iron caps and covers for manholes, $12 each; stone inlets and iron covers, $17 each; tunneling, $2.25 per lin. ft.; limestone curbing, 52 cts. per lin. ft.; earth filling, 33 cts. per cu. yd.; brick paving, complete, Galesburg or Wabash brick, $1.28 per sq. yd.; Alton repressed brick, $1.05 per sq. yd.; surface excavation placed in fill, 17 cts. per cu. yd.

SEWERS.—South Bend, Ind.—L. A. Hull, Cy. Clk., writes us that the contract for a sewer in West Washington St. has been awarded to C. H. Defrees, South Bend, at the following prices, this being the lowest bid: 18 and 20-in. pipe sewer, 62 cts. per ft.; inlets, $1.75 each; conduits, 20 cts. per ft.; manholes, $1 each; manhole covers, $5 each.

Allegheny, Pa.—The contract for 2,200 ft. of 18-in. pipe sewer in Howard St. has been awarded to P. O'Donnell, at $1.25 per ft.; No. 1 inlets, at $15 each; No. 2 inlets, $45; manhole shafts, at $25.

Fort Wayne, Ind.—Frank M. Randall, Cy. Engr., writes us that bids have been opened for the following work: 12-in. pipe sewer, 325 ft.; 15-in., 1,315 ft.; 18-in., 625 ft.; 12-in. connection pipe, 112 ft.; catch-basins, 7; manholes, 7; 15 × 6-in. branches, 54; 12 × 6-in. branches, 16; 18 × 12-in. branches, 4; rubble masonry, 2 cu. yds.; timber foundation, 180 ft.; sheeting, 120 ft.; average cut, 9 ft.; soil, gravel and sand. The contract was awarded to M. Singleton, at 54 cts. per lin. ft., the other bids being A. Rieg, 63 cts.; T. Emple, 64½ cts.; J. Remus, 70 cts.; J. Berteis, 71 cts.; A. Vesey, 78 cts.; G. Ehrman, 79 cts.; J. Derheimer, 79 cts.; W. Oetting, 83 cts.; all bidders residents of Fort Wayne.

Hamilton, O.—The awarding of four sewer contracts was noted in last week's issue under Sewers. L. A. Dillon, Cy. Engr., writes us that the bids for district No. 1, contract No. 2, were as follows; contract awarded to the Greenville Construction Co.:

Bids Received at Hamilton, O., Nov. 20 for a Sewer in District No. 1.

Quantities.	J. C. Cross, $14,486.	Berry & Meehan, $14,339.	W. H. Loudan, $14,562.	W. B. Boaz, $17,190.	R. F. Walker & S. R. Robinson, $13,433.	Struck, Wilson & Kinch, $14,177.	Bartow & Clements, $14,394.	Leiter & Vandervear, $15,869.	T. McNerney, $10,559.	Greenville Constn. Co., $12,792.	A. F. Nims, $14,142.	W. R. Mercer & Son, $14,088.	Dresner, Scott & James, $14,077.	Wm. White, $14,613.
10-in. pipe .....2,175 ft	$0.14	$0.19	$0.18	$0.23	$0.16	$0.19	$0.25	$0.24	$0.18	$0.30	$0.37	$0.15	$0.20	$0.19
8-in. " .....19,000 "	.11	.16	.15	.17	.12	.14	.16	.20	.15	.28	.22	.12	.15	.14
Excav. 6 to 8 ft. .1,000 "	.30	.20	.25	.20	.20	.22½	.26	.28	.15	.13	.26	.30	.12	.25
8 to 10 ft.....12,500 "	.40	.33	.35	.40	.30	.33½	.36	.39	.21	.18	.31	.40	.36	.36
10 to 12 ft..... 6,200 "	.50	.45	.50	.60	.50	.52	.45	.52	.31	.23	.37	.50	.52	.52
12 to 14 ft..... 1,000 "	.60	.75	.65	.85	.58	.82	.63	.72	.44	.35	.44	.60	.62	.70
14 to 16 ft..... 550 "	.60	.90	.75	1.10	.70	1.20	1.00	.98	.55	.45	.53	.90	.90	.85
Manholes 37	30.00	28.00	33.00	25.00	30.00	25.00	25.00	29.25	20.00	30.00	29.00	25.00	29.00	31.00
Lamphole 50	5.00	3.00	2.50	2.25	5.00	2.80	1.65	4.90	2.50	4.00	2.60	5.00	1.80	1.70
Flush tanks 19	40.00	35.00	35.00	35.00	45.00	36.00	24.00	53.00	40.00	40.00	29.00	50.00	46.00	32.00
Iron pipe, tons. 2	30.00	30.00	30.00	30.00	35.00	28.00	28.00	29.00	30.00	40.00	29.00	30.00	23.00	23.00
[1]Lead pipe .... 100 ft.	.25	.30	.25	.25	.15	.25	.16	.20	.15	.20	.24	.25	.15	.15
[2]Lead pipe .... 200 "	.50	.45	.40	.40	.26	.40	.25	.40	.20	.35	.32	.35	.20	.20
Cocks & specials 19	3.00	5.00	3.00	3.00	2.00	3.00	5.00	3.00	2.00	4.00	6.00	3.00	5.00	3.00
[3]Lumber, M. ft.. 20	20.00	.02	15.00	.02	.02	.001	.02	.018	.005	.005	5.00	.01¼	.01	.02

[1] Without trenching. [2] With trenching. [3] Left in trench.

STONE PAVING.—Allegheny, Pa.—Two contracts, aggregating 4,400 sq. yds., for paving with Ligonier blocks, have been awarded to Keeling, Ridge & Co., at $2 per sq. yd.; excavation, 28 cts. per cu. yd.; new curbing, 50 cts. per lin. ft.; resetting and redressing old curb, 15 cts. per lin. ft.; granite crossings, 90 cts. per lin. ft.

WOOD PAVING.—Chicago, Ill.—The lowest bids for paving three streets with cedar blocks were as follows: Gardner City Paving & Post Co., one street, at 85 cts. per sq. yd. for paving, and 62 cts. per lin. ft. for curbing; J. B. Smith, two streets, at 78 and 80 cts. per sq. yd for paving, 10 and 15 cts. per cu. yd. for filling, and 67 and 68 cts. per lin. ft. for curbing.

BRICK PAVING.—Massillon, O.—For paving Diamond alley with fire brick, H. W. Loeffler bid $1.47 per sq. yd., and John B. Snyder, $1.55.

Allegheny, Pa.—The contract for 2,600 sq. yds. of paving with vitrified brick in Ley St. has been awarded to Carson & Hutchison, at $1.34 per sq. yd.; excavation, 20 cts. per cu. yd.; curbing, 45 cts. per lin. ft.; granite crossing, 80 cts. per lin. ft.

PAVING BRICK.—Jacksonville, Fla.—The bids recently received for supplying the city with 30,000 sq. yds. of vitrified paving brick, to be delivered within 90

STREET LIGHTING.—New York, N. Y.—The gas commission has awarded contracts for lighting the city next year, at a total cost of $985,000. The Consolidated Gas Co. will light 14,001 lamps at $17.50 a year for each lamp; Equitable, 4,113, at $12; Standard, 2,436, at $13; Central, 1,199, at $24; Northern, 2,184, at $28; Yonkers, 655, at $28, and the New York & New Jersey Globe Gas Light Co., 158, at $22. The electric light contracts were divided between the Brush, United States, Mount Morris, Madison Square (successor to the Thomson-Houston), Harlem, Manhattan, Edison and North River Electric Light companies. All but the Edison bid 40 cts. per lamp per night, the latter asking 45 cts.

METAL MARKET PRICES.

LEAD.—New York: 3.1 to 3.15 cts. Chicago: 2.97 cts. St. Louis: 2.85 to 2.9.

NAILS.—Pittsburg: 90 cts. for wire, and 80 to 85 cts. for cut at mill, in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $1.9; plain, $1.2 to $1.25 for carloads at mill.

FOUNDRY AND PIG IRON.—New York: $10 to $13. Pittsburg: $10.50 to $11.25. Chicago: $9.25 to $10.25.

TRACK MATERIAL.—New York: angle bars, 1.25 to 1.4 cts.; spikes, 1.45 to 1.6 cts.; track bolts, 2 to 2.1 cts. with square, and 2.15 to 2.3 cts. with hexagon nuts. Chicago: angle bars, 1.3 to 1.35 cts.; spikes, 1.6 to 1.7 cts.; track bolts, 1.9 to 2 cts., with hexagon nuts.

RAILS.—The rail makers in the pool have established rates for rails of 45 lbs. and over for delivery in 1895, making a considerable reduction. New York: $22 at eastern mills and $22.75 at tidewater; old rails, $11 to $12 for iron and $9 to $10 for steel; steel rails, fit for relaying, $14; light rails, $22 to $24; girder rails, $24. Pittsburg: $22 for standard sections of 45 lbs. and over; old rails, $12 to $12.50 for iron and $10 for steel. Chicago: $25 for this year and $23 for 1895; old rails, $10.50 for iron and $7 to $9 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.2 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.2 to 1.35 cts.; steel plates, 1.2 to 1.4 cts. for tank, 1.4 to 1.45 cts. for shell, 1.5 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.2 to 1.3 cts.; channels, 1.2 to 1.3 cts.; angles, 1.1 to 1.2 cts.; tees, 1.35 to 1.4 cts.; universal mill plates, 1.1 to 1.2 cts.; steel plates, 1.15 to 1.25 cts. for tank, 1.3 to 1.35 cts. for shell, 1.35 to 1.4 cts. for flange, 2.5 to 3.75 for ordinary firebox, and 3.35 to 3.5 cts. for locomotive firebox. Chicago: beams, 1.5 cts.; channels, 1.5 cts.; angles, 1.4 to 1.45 cts.; tees, 1.65 cts.; universal plates, 1.4 to 1.45 cts.; steel plates, 1.35 to 1.4 cts. for tank, 1.65 to 2.1 cts. for flange, 1.65 to 5 cts. for firebox.

IRON AND STEEL MARKET.—The "Journal of Commerce," New York, says that in the pig iron market there is no change of importance. Irregular and low prices are made where opportunities seem favorable for putting through a good-sized deal. That in turn has more or less unfavorable bearing, and the market remains weak in tone, although no radical changes in prices are made. Old material remains quiet and unchanged. In the market for finished products no change has taken place. Railway patronage in this quarter has not improved, and measurable results have come from the negotiation pending latterly for structural steel, tank plates, etc. In the lighter forms, ordinary merchant bars, etc., the movement is still backward and prices remain low.

INDUSTRIAL NOTES.

J. ASHLEY, of Gananoque, Ont., has opened works for the manufacture of electric motors, dynamos, etc.

THE NATIONAL SEWER PIPE CO., of Barberton, O., has an order for about eight miles of sewer pipe for Hamilton, O.

THE CAMERON TRACKING CO., of Brooklyn, N. Y., has been formed to manufacture overhead tramways and carriers for conveying packages, freight, etc., in factories, warehouses, etc.

THE NATIONAL SWITCH & SIGNAL CO., of Easton, Pa., has completed an interlocking plant of 14 levers for the Lake Superior Terminal & Transfer Ry. Co. at West Superior, Wis.

THE BUCYRUS STEAM SHOVEL & DREDGE CO., of South Milwaukee, Wis., has increased its capital stock from $150,000 to $250,000. The company's works were described and illustrated in our issue of Nov. 16, 1893.

CAR WHEELS.—A company is being formed at Perth, Ont., with a capital stock of $50,000, for the manufacture of car and locomotive wheels. Among the promoters are W. H. Churchill, W. C. Wilson and J. M. Balderson.

QUEEN & CO., Philadelphia, Pa., state that there is an excellent prospect of a speedy adjustment of their affairs. Meanwhile, their large stock has been kept up and orders are being filled as usual, but very great reductions have been temporarily made in the prices of the present stock.

THE TOLEDO CONSTRUCTION CO., of Toledo, O., reports contracts for building water-works in Decatur, Ind., and Wiltshire, O., and an extension of four miles in Hicksville, O., and is also completing water-works and electric light plants in Napoleon, O. It has contracts for four miles of pipe sewers in Warren, O., and five miles of brick sewer in Toledo, O. Supt., C. E. Coon.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, Pa., has acquired the rights, patents, etc., of the Consolidated Electric Storage Co., General Electric Launch Co., Electric Launch & Navigation Co., Accumulator Co. and the battery patents of the Brush Electric Co. and General Electric Co., thus virtually consolidating all the storage battery patents and stopping litigation among the former competitors.

THE BROWN HOISTING & CONVEYING MACHINE CO., Cleveland, O., has purchased the business of the crane department of the Yale & Towne Mfg. Co., of Stamford, Conn. This transfer includes all of the drawings, records and patterns relating to the crane business heretofore conducted by the latter company, comprising the designing and building of traveling, locomotive, jib, pillar and other cranes. The transfer took effect on Dec. 1.

THE CENTRAL SEWER PIPE CO., of Pittsburg, Pa., has been organized by a combination of 28 firms, mostly in the Ohio valley, representing a capital of $2,000,000. Pres., F. H. Coleman (of the United States Fire Clay Co. and Ohio Sewer Pipe Co.); Gen. Man., T. F. Henderson. It is said that it has been decided to advance prices, and that the combine of sewer pipe manufacturers, other than those using fire-clay, which has its offices in Akron, O., will act in harmony with the new company.

COFFIN & STANTON, of New York, the banking firm which failed recently, has come unusually well out of its troubles. Mr. Erb, the receiver, having reported that he has disposed of securities of the par value of $223,000, upon which he realized $219,000, of which $213,000 was applied in reduction of loans and $6,000 added to the general fund. Some of the water companies in which the firm was interested have been reorganized in the interest of the bondholders without loss to the stockholders.

CREOSOTING WORKS.—The Louisville & Nashville R. R. advertises in our columns that it will lease its creosoting works on the Pascagoula River, 44 miles

west of Mobile, Ala. The works are fitted for using dead oil of coal tar, and are accessible to an immense supply of yellow pine timber, which may be rafted to New Orleans at a small cost. They are well known to consumers, having heretofore been leased to the late Mr. J. W. Putnam. Further particulars may be obtained from Mr. C. Marshall, Supt., New Orleans, La., or Mr. R. Montford, Ch. Engr., Louisville, Ky.

THE WHITING FOUNDRY EQUIPMENT CO., of Chicago, is building several large traveling cranes, and has orders for several Whiting cupolas. The new plant of this company at Harvey, Ill., is now in full operation, and extensions in the way of a new cupola shop, 50 × 120 ft., are under consideration. Among recent orders are a 10-ton traveling crane for the National Tin Plate Co.; a 10-ton pendant traveler of 58 ft. span for the Glamorgan Co., of Lynchburgh, Va.; and a 5-ton jib crane for the Lobdell Car Wheel Co. Recent shipments of cupolas were made to Santa Ana, Cal., Fairhaven, Mass., and Newark, O.

MOHN & HOFF have opened an office at 915 Association Building, Chicago, and will carry on the business of consulting engineers and contractors, making a specialty of iron and steel construction for bridges, buildings and general structural iron work. Both have had extensive experience in these lines, Mr. Mohn having been associated with Mr. A. Gottlieb for about five years, two years in charge of his office, and since Mr. Gottlieb's death has been with Mr. C. L. Strobel, of Chicago. Mr. Hoff was formerly with Mr. Gottlieb, and has for the past four years had charge of the estimating department of the Milwaukee Bridge & Iron Works.

THE SECKNER CONTRACTING CO., Unity Building, Chicago, has recently been awarded contracts for laying water pipe for the Grant Land Association, Chicago, at $7,500, and building a 175,000-bushel grain elevator at Gardner, Kan., for which it has prepared plans and specifications. Plans for another elevator are being prepared. The company has recently completed, and the town has accepted, a water-works plant at East Chicago, Ind., the final estimate for which was $104,800, and one at Chicago Heights, Ill., W. B. Ewing, Engr., Chamber of Commerce Bldg., Chicago, final estimate of cost, $60,000. The Harvey Boiler Works, Harvey, Ill., built the standpipes for both works.

THE INDUSTRIAL WORKS, of Bay City, Mich., report among recent orders an electric crane for Henry R. Worthington, a second overhead traveling crane for the Lincoln Foundry & Machine Co., Pittsburg; transfer crane for the Wheeling & Lake Erie Ry., and turntable for the Manistique Ry.; a locomotive steam crane of large capacity for the Washington Navy Yard, and another, intended for the heaviest service, for Booth & Flinn, of Pittsburg. An order for three heavy self-propelling wrecking cranes has been awarded to these works by the Boston & Albany R. R., and a similar crane is being built for the Norfolk & Western R. R. Orders have been received for two electric overhead traveling cranes for the Beaver Tin Plate Co., New Lisbon, Ohio; two electric jib cranes of 30 tons capacity, and one locomotive crane for the National Pipe & Foundry Co., Scottdale, Pa.; also one 30-ton pillar crane for the Michigan Central R. R., and one 35-ton steam crane for the Southern Pacific R. R. The works have recently made shipments as follows: A special steam crane for service in the yards of the Lukens Iron & Steel Co., Coatesville, Pa.; high capacity locomotive steam cranes to the Edgar Thomson Steel Works, Jones & Laughlins, and the National Tube Works Co., all of Pittsburg and vicinity; pillar and transfer cranes to the Chicago, Rock Island & Pacific, Cincinnati, Hamilton & Dayton, Baltimore & Ohio Southwestern and Lehigh Valley railways; electric transfer table to the Pittsburg Locomotive Works; electric overhead traveling crane to the Lincoln Foundry & Machine Co., of Pittsburg; pile drivers to the Mobile & Birmingham Ry. and Atlantic Coast Line, and wrecking cars to the Chicago, Peoria & St. Louis R'y R.

NEW COMPANIES.—Philadelphia Construction Co., Camden, N. J.; $50,000, with $5,000 paid in; Gilbert H. Favier and Albert A. Mershon, of Philadelphia, Pa.; George W. Coles, of Camden, N. J.

Yawger Construction Co., Bucyrus, O.; $40,000; A. L. Yawger, J. L. Leonard and Geo. C. Terry.

Best Brick Co., Mechanicsville, N. Y.; $10,000; J. B. Orcutt, E. W. Swartout and H. E. Barton.

Monroe Brick & Tile Co., Stroudsburg, Pa.; $15,000, with $1,500 paid in; Treas., James Edinger.

Pearl White Lime & Cement Co., Pearl, Ill.; $20,000; Wm. H. Crow, Wm. Hess and Jacob D. Hess.

Parks Boiler Furnace Co., Chicago, Ill.; $400,000; Samuel I. Parks, W. R. Parks and R. S. Bates.

Gibbs Boiler Co., Mount Holly, N. J.; $200,000, with $1,000 paid in; R. B. Lamb and Eugene U. Gibbs.

Entiat Improvement Co., Waterville, Wash.; irrigation; $8,000; Frank Ford, A. E. Case and M. B. Howe.

San Carlos Construction Co., Pittsburg, Pa.; $150,000, with $75,000 paid in; C. L. Straub and J. M. Forse.

Granite City Construction Co., Granite City, Ill.; $20,000; Martin Wall, John Corley and Charles Pardesky.

American Mining Machine Co., Pittsburg, Pa.; $10,000; George F. Myers, H. B. Coyle and J. H. Palmer.

Brigg Automatic Easy Patent Haulage Attachment Co., Chicago, Ill.; F. J. Patterson, Addison Bybee and P. Malden.

Bellingham Bay Hydraulic Mining Co., Fairhaven, Wash.; $30,000; Frank J. Hamilton, C. C. Taylor and Wm. Hedge.

Brooklyn Wharf & Warehouse Co., Brooklyn, N. Y.; $30,000,000; Thomas A. McIntyre, David Dorr, Jr., and J. S. T. Stranahan.

Northern Construction Co., Brooklyn, N. Y.; $10,000; Ernest W. Emmons, Jersey City, N. J.; J. S. Deseilding and A. L. Crowell, Brooklyn.

Pittsburg Gas & Oil Producing Co., Fairmount, W. Va.; $100,000, with $500 paid in; R. L. Reed, Boothsville; J. A. Clark and O. S. McKinney, Fairmount.

Fairmount Ice Co., Fairmount, W. Va.; ice plants, water-works and electric light; $100,000, with $2,000 paid in; A. B. Fleming, C. L. Smith and J. E. Watson.

Niagara Engineering Co., Buffalo, N. Y.; $10,000; electric light and power plants; L. Bradley Dorr, Clifton, N. Y.; C. W. Nobles, and Leon Esquier, Buffalo, N. Y.

Smiths Railroad Lubricator Co., Jersey City, N. J.; $50,000, with $1,000 paid in; F. J. Jenner and Oliver W. Shead, New York city; Elmer Fletcher, 450 Hancock St., Brooklyn, N. Y.

New Jersey & Delaware Electric Forging Co., Newark, N. J.; $250,000, with $1,000 paid in; Edward Kenny, Newark, N. J.; F. A. Nichols, Arlington, N. J; and B. J. Fredericks, New York, N. Y.

New York & New Jersey Granite & Paving Co., Paterson, N. J.; $100,000, with $1,000 paid in; Frank Seaman, Rockville Center, N. Y.; Leonard H. Doremus, Paterson, N. J.; Michael J. Fenton, New York city.

NOTICE TO CONTRACTORS.

PROPOSALS FOR WATER PIPE.

Sealed proposals will be received at the office of the Cambridge Water Board, City Hall, Cambridge, Mass., until 3 o'clock, p. m, of Thursday, December 20, 1894, for furnishing and delivering in Cambridge and Belmont, cast iron and riveted steel plate water pipe with special castings and fittings.

Two alternative plans are proposed differing in the material to be used in the manufacture of the pipe.

By the plan denominated A, all the pipe and specials are to be of cast iron.

By the plan demoninated B, a part of the pipe is to be of riveted steel plate with wrought iron fittings, and part of the pipe with specials to be of cast iron.

All bids must be made upon blank forms furnished, must give the price proposed for each separate item of the work, both in writing and in figure and be signed by the bidder with full name and address.

All bids will be compared on the basis of the engineer's estimate of the quantities required by the two alternative plans proposed, either one of which plans may be adopted.

Some of the approximate quantities required by plan A are as follows:

5,473 tons of 40 inches cast iron water pipe with bell and spigot ends.

176 tons of 40 inches cast iron water pipe with flanged ends.

75 tons of special iron castings.

Some of the approximate quantities required by plan B are as follows:

2,100 tons of 40 inches cast iron pipe with bell and spigot ends.

44 tons of 40 inches cast iron pipe with flanged ends.

35 tons of special iron castings.

14,300 lineal feet of 40 inches riveted stee water pipe.

781 lineal feet of 40 inches riveted steel water pipe, with flanged ends.

20,000 lbs. of wrought iron or steel special fittings for 40-inch riveted steel pipe.

Each bid is to be accompanied by a certified check for two thousand dollars ($2,000), payable to the city of Cambridge, said check to be returned to the bidder, unless forfeited as specified below.

A bond for not less than 25 per cent., nor more than 50 per cent., of the amount of the contract will be required for the faithful performance of the contract, the sureties to be satisfactory to the Cambridge Water Board.

The person or persons to whom the contract may be awarded will be required to appear at the office of the Water Board, with sureties offered by him or them, and execute the contract within six days (not including Sunday) from the date of notification of such award and the preparation and readiness for signature of the contract, and in case of failure or neglect to do so, he or they will be considered as having abandoned it, and the check accompanying the proposal shall be forfeited to the city of Cambridge.

Each bidder is required to state in his bid his full name and place of residence, and the names of all persons interested with him, and if no other person be so interested he shall distinctly state the fact; also, that it is made without any connection with any other person making any bid for the above work; and also, that the bid is in all respects fair, and made without collusion or fraud, and that no person acting for or employed by the city of Cambridge is directly or indirectly interested therein, or in the supplies or work to which it relates, or in any portion of the profits thereof. Each bidder is also required to make a statement indicating what similar work he has done, and to give references that will enable the Water Board to judge of his experience, skill and business standing.

Specifications can be obtained after Dec. 5, 1894, by application at the office of the City Engineer.

The right is reserved by the Cambridge Water Board to reject any or all proposals received.

Proposals to be addressed to the Cambridge Water Board and endorsed "Proposals for Furnishing Water Pipe."

L. M. HASTINGS,
City Engineer.

Cambridge, Nov. 30, 1894. 49-2t

NOTICE TO SEWER CONTRACTORS.

Sealed proposals for furnishing all materials and performing all the work required for the construction of about seventy-four (74) miles of sewers, six (6) miles of which are to be of brick, varying in size from twenty-six (26) to fifty-two (52) inches in diameter; and sixty-eight (68) miles of pipe sewers, varying in size from eight (8) to twenty-four (24) inches in diameter; also eight hundred and forty-three (843) manholes, two hundred and ten (210) flushtanks, together with siphons for five (5) river crossings—will be received by the Mayor of the city of San Antonio, Tex., until twelve (12) o'clock noon, December 20th, 1894.

Plans and specifications can be seen on and after November 24th, 1894, at the office of A. C. Pancoast, City Engineer of San Antonio, or at the office of Samuel M. Gray, Consulting Engineer, Providence, R. I.

The work is divided into ten districts. Bids will be received for each or any district or for the entire system.

Bids will also be received for doing the work only, the city of San Antonio furnishing the materials, excepting sand.

Each proposal must be accompanied by a cash deposit or certified check as liquidated damages conditioned that the party making the bid will execute the contract. The amount of the deposit or check required will be five hundred dollars ($500.00) for each and every district bid upon, or five thousand dollars ($5,000.00) for the entire system.

It is to be understood that the party to whom the contract is awarded will, so far as it is possible, employ laborers who reside in San Antonio. It is also understood that the contractors will give preference to products of home manufacture, when quality and price are equal.

The right to reject any and all bids is hereby reserved.

HENRY ELMENDORF,
Mayor of San Antonio, Tex.

Attest.
E. R. NORTON, City Clerk. 47-4t

PRESERVATION OF TIMBER.

CREOSOTE WORKS TO LET.

The Louisville & Nashville Railroad Company will lease for a term of years its complete and extensive works for creosoting timber with Dead Oil of Coal Tar, which are located on its line at its crossing of Pascagoula River, 44 miles west of Mobile.

These works are accessible to an immense supply of yellow pine timber, which may be rafted to the works at small cost, and are well known to consumers, having heretofore been leased to the late Mr. J. W. Putnam.

This is a favorable opportunity for contractors or dealers to acquire a timber preserving plant of established reputation, with good transportation facilities for export or domestic consumption.

The Company will lease these works only to parties of good reputation and credit, who will prosecute the business with enterprise and vigor.

For further particulars address
C. MARSHALL, Supt., New Orleans, La.;
or R. MONTFORT, Chief Engineer, Louisville, Ky. 50-3t

STONE DAM.

Sealed proposals will be received by the Holyoke Water Power Co., at their office in Holyoke, Mass., until noon of Feb. 15, 1895, for the construction of a stone dam, with abutments and wing walls, on the Connecticut River, in the City of Holyoke and Village of South Hadley Falls.

Summary of work.

34,500 cu. yds. rubble stone masonry.

1,825 cu. yds. granite dimension masonry in upper courses of dam.

7,000 cu. yds. granite dimension masonry in face of dam.

2,500 cu. yds. split granite masonry in back of dam.

2,300 cu yds. granite dimension masonry in abutments and wing walls.

Forms of proposals, specifications and plans may be obtained at the office of the company. A certified check for $10,000, made payable to the Holyoke Water Power Co., must accompany each bid.

The company reserves the right to reject any or all bids.

HOLYOKE WATER POWER CO.,
50-7t By EDWARD S. WATERS, Treas.

NOTICE TO CONTRACTORS.

WEST PITTSTON, PA., SEWERS.

Sealed proposals, addressed to O. C. Foster, President, will be received by the Borough Council of West Pittston, Pa., until 8 o'clock p. m., December 20, 1894, and publicly opened and read immediately thereafter, for furnishing material and constructing, in accordance with plans and specifications, the sewerage system.

The work consists in furnishing and laying approximately:

12,560 ft. of 8-in. vitrified pipe sewer.
2,180 ft. of 12-in. " " "
3,330 ft. of 15-in. " " "
1,425 ft. of 18-in. " " "
1,320 ft. of 20-in. " " "
2,120 ft. of 22-in. " " "
1,570 ft. of 24-in. " " "
1,680 ft. of 30-in. " " "
Also 150 ft. of 36-in. brick sewer.
300 ft. of 50-in. " "
480 ft. of 2 ft. 4 in. × 3 ft. 6 in. brick sewer.
1,210 ft. of 2 ft. 6 in. × 3 ft. 9 in. brick sewer.
720 ft. of 2 ft. 10 in. × 4 ft. 3 in. brick sewer.
760 ft. of 3 ft. 4 in. × 5 ft. brick sewer.
Also 835 Y-branches.
79 manholes.
44 catch-basins.
6 flush tanks.

The borough council reserves the right to reject any or all bids.

A certified check, 2 per cent. of the amount of the bid, to accompany each proposal.

Plans and profiles can be seen and specifications and forms of proposals procured on or after 7th December at the Borough Council Chamber, or at the offices of the Engineers, 137 Broadway, New York, and 700-701 Lewis Block, Pittsburg, Pa. Communications should be addressed Pittston, Pa.

By order of the Council,
O. C. FOSTER, President.
H. J. SANDERS, Secretary.
POTTER & FOLWELL, Engineers. 48-3t